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ABSTRACT

This module (part of a series of 24 modules) is on human development, student characteristics, and learning styles. The genesis of these materials is in the 10 "clusters of capabilities," outlined in the paper, "A Common Body of Practice for Teachers: The Challenge of Public Law 94-142 to Teacher Education." These clusters form the proposed core of professional knowledge needed by teachers in the future. The module is to be used by teacher educators to reexamine and enhance their current practice in preparing classroom teachers to work competently and comfortably with children who have a wide range of individual needs. The module includes objectives, scales for assessing the degree to which the identified knowledge and practices are prevalent in an existing teacher education program, and self-assessment test items. Topics discussed in this module include variables that affect learning and individual differences along style and process dimensions. A bibliography, a list of supplementary readings, and journal articles are included on the subject of gathering and using information about student development in planning and carrying out instruction. (JD)

HUMAN DEVELOPMENT, HUMAN DIFFERENCES AND LEARNING

PREPARED BY

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Extending the Challenge:

Working Toward a Common Body of Practice for Teachers

Concerned educators have always wrestled with issues of excellence and professional development. It is argued, in the paper "A Common Body of Practice for Teachers: The Challenge of Public Law 94-142 to Teacher Education,"* that the Education for All Handicapped Children Act of 1975 provides the necessary impetus for a concerted reexamination of teacher education. Further, it is argued that this reexamination should enhance the process of establishing a body of knowledge common to the members of the teaching profession. The paper continues, then, by outlining clusters of capabilities that may be included in the common body of knowledge. These clusters of capabilities provide the basis for the following materials.

The materials are oriented toward assessment and development. First, the various components, rating scales, self-assessments, sets of objectives, and respective rationale and knowledge bases are designed to enable teacher educators to assess current practice relative to the knowledge, skills, and commitments outlined in the aforementioned paper. The assessment is conducted not necessarily to determine the worthiness of a program or practice, but rather to reexamine current practice in order to articulate essential common elements of teacher education. In effect then, the "challenge" paper and the ensuing materials incite further discussion regarding a common body of practice for teachers.

Second and closely aligned to assessment is the developmental perspective offered by these materials. The assessment process allows the

*Published by the American Association of Colleges for Teacher Education, Washington, D.C., 1980 ($5.50).

user to view current practice on a developmental continuum. Therefore, desired or more appropriate practice is readily identifiable. On another, perhaps more important dimension, the "challenge" paper and these materials focus discussion on preservice teacher education. In making decisions regarding a common body of practice it is essential that specific knowledge, skill and commitment be acquired at the preservice level. It is also essential that other additional specific knowledge, skill, and commitment be acquired as a teacher is inducted into the profession and matures with years of experience. Differentiating among these levels of professional development is paramount. These materials can be used in forums in which focused discussion will explicate better the necessary elements of preservice teacher education. This explication will then allow more productive discourse on the necessary capabilities of beginning teachers and the necessary capabilities of experienced teachers.

In brief, this work is an effort to capitalize on the creative ferment of the teaching profession in striving toward excellence and professional development. The work is to be viewed as evolutionary and formative. Contributions from our colleagues are heartily welcomed.

This paper presents one module in a series of resource materials which are designed for use by teacher educators. The genesis of these materials is in the ten "clusters of capabilities," outlined in the paper, "A Common Body of Practice for Teachers: The Challenge of Public Law 94-142 to Teacher Education," which form the proposed core of professional knowledge needed by professional teachers who will practice in the world of tomorrow. The resource materials are to be used by teacher educators to reexamine and enhance their current practice in preparing classroom teachers to work competently and comfortably with children who have a wide range of individual needs. Each module provides further elaboration of a specified "cluster of capabilities," in this case preparing teachers to gather and utilize information about student development in planning and carrying out instruction.

The topic addressed in the module is potentially encompassing of a wide range of topics related to learner characteristics. However, an effort has been made to limit the topics covered in this module to ones not dealt with in other modules in this series. At this time the author would direct the reader especially to the following modules for information on relating instruction to certain types of learner characteristics:

Allen, J. Clark, F., Gallagher, P., & Scofield, F. Classroom Strategies for Accommodating Exceptional Learners.

Birch, J. W. Variables in Exceptionality: The Meaning of Exceptionality and the Nature and Scope of Special Education.

Brolin, D: Life Skills Education.

Graves, M. F. Classroom Teacher's Role in Reading Instruction in the Intermediate and Secondary Grades.

Henderson, R. W. Teacher Relations with Minority Students and Their Families.

Hofmeister, A. H., & Preston, C. N. Curriculum-Based Assessment and Evaluation Procedures.

Morreau, L. Behavior Modification Skills for Teachers.

O'Connell-Mason, C.Y., & Raison, S.B. Curriculum Assessment and Modification.

Table of Contents

Objectives For Teacher Educators and For Incorporation Into Teacher Education Curricula

Objectives for this Module

At the end of this guided study, the reader should be able:

1. To understand salient learning and developmental differences.
2. To conceptualize learner characteristics within an individual diffences framework.
3. To understand the role of individual differences in adaptive instruction.
4. To understand the relationship of the individual differences framework outlined to PL 94-142.
5. To provide the teacher education students with laboratory activities that aid in understanding important dimensions of learning and development.

Reasonable Objectives for Teacher Education

Teacher preparation programs should prepare teachers who are able:

1. To identify important characteristics of students that affect academic, cognitive, affective and sociocultural development.
2. To observe and assess important individual differences underlying classroom learning.
3. To utilize individual differences information to provide a vehicle for adapting instruction to individual characteristics and needs.

Rating Scale for Teacher Education Program

How would you rate your professional preparation program?

_____ 1. Students in teacher education program receive no instruction in human development and individual differences.

_____ 2. Students receive foundational education regarding human development and development differences.

_____ 3. Students receive instruction in human development and individual differences and how learner characteristics can affect students' learning, as well as cognitive, affective and sociocultural development.

_____ 4. Students receive instruction in human development and individual differences, the relationship of these to student academic, cognitive and social development and how knowledge of student characteristics can be used to adapt instructional practices.

_____ 5. Students receive instruction in human development and individual differences and first-hand experience observing and informally assessing student characteristics. They understand the relationahip of development and individual differences for student development and have first hand experience adapting school activities to student characteristics.

Self-Assessment

This module begins with a pretest. The purpose is to help you determine how familiar you are with the content.

1. What are the major learning and thinking dimensions along which learners differ?
2. What are the cognitive and affective milestones of infancy, early childhood, middle childhood, and adolescence?
3. What is the difference between a deficiency, a disruption, and a "difference?" How might each characteristic be dealt with instructionally?
4. What is the difference between capitalization, compensation, and remediation? When is each technique optimally effective?
5. What is the relationship between styles of learning/thinking and effective instruction?

The purpose of this module is to familiarize the reader with the learner characteristics that are most important in the teaching/learning process. The amount and quality of learning are influenced by the cognitive and affective developmental levels of learners. But, the picture is more complex and much more interesting than simply looking at developmental levels when selecting and organizing materials for instruction. A host of other characteristics that learners possess affect the manner in which each individual learns.

To facilitate your understanding of the relationship of learner characteristics to one another and to aspects of instruction or the learning environment, a model for studying learners -- called an individual framework -- is introduced in the following section. In subsequent sections, categories of learner characteristics are considered in more detail. Suggestions for instructing preservice teachers in the principles and subject matter of human development and learning are given. Finally, additional reading materials and a supplementary bibliography are provided.

Overview

The field of individual differences in learning and instruction has emerged as a new and potent area of study in educational psychology. Its ancestral field, differential psychology, viewed cognitive abilities as static psychological constructs. Individuals were believed to differ on the amount of ability possessed in a certain domain, and a test score was seen as the embodiment of this ability, that is, ability was seen as a product.

The individual differences perspective offers a radical new view of the relationship of learning and development to instruction. The task for educators and psychologists is not to determine how well given individuals perform on tests that purportedly measure particular congitive skills but, rather, to elucidate individual differences along salient information-processing parameters. The emphasis is on process, on different routes to the same instructional goals, when the goals are appropriate to the students needs and characteristics.

There is outlined in the following subsection a model which we feel provides a useful framework for understanding human growth, development, and learning. It shows the possible increments in learning when relevant intrapersonal characteristics are identified and taken into account, and the learning difficulties stemming from conflicts between a learner's preferred modes of processing information and particular task demands are recognized and dealt with.

Model of Individual Differences

From an individual differences perspective, learning is a function of individual characteristics (i.e., intrapersonal variables) and aspects of instruction (i.e., situational variables). A major contribution of work in this area is the demonstration that student characteristics often interact with instructional variables to affect the amount and type of learning taking place. Figure 1 shows the theoretical relation of the constructs.

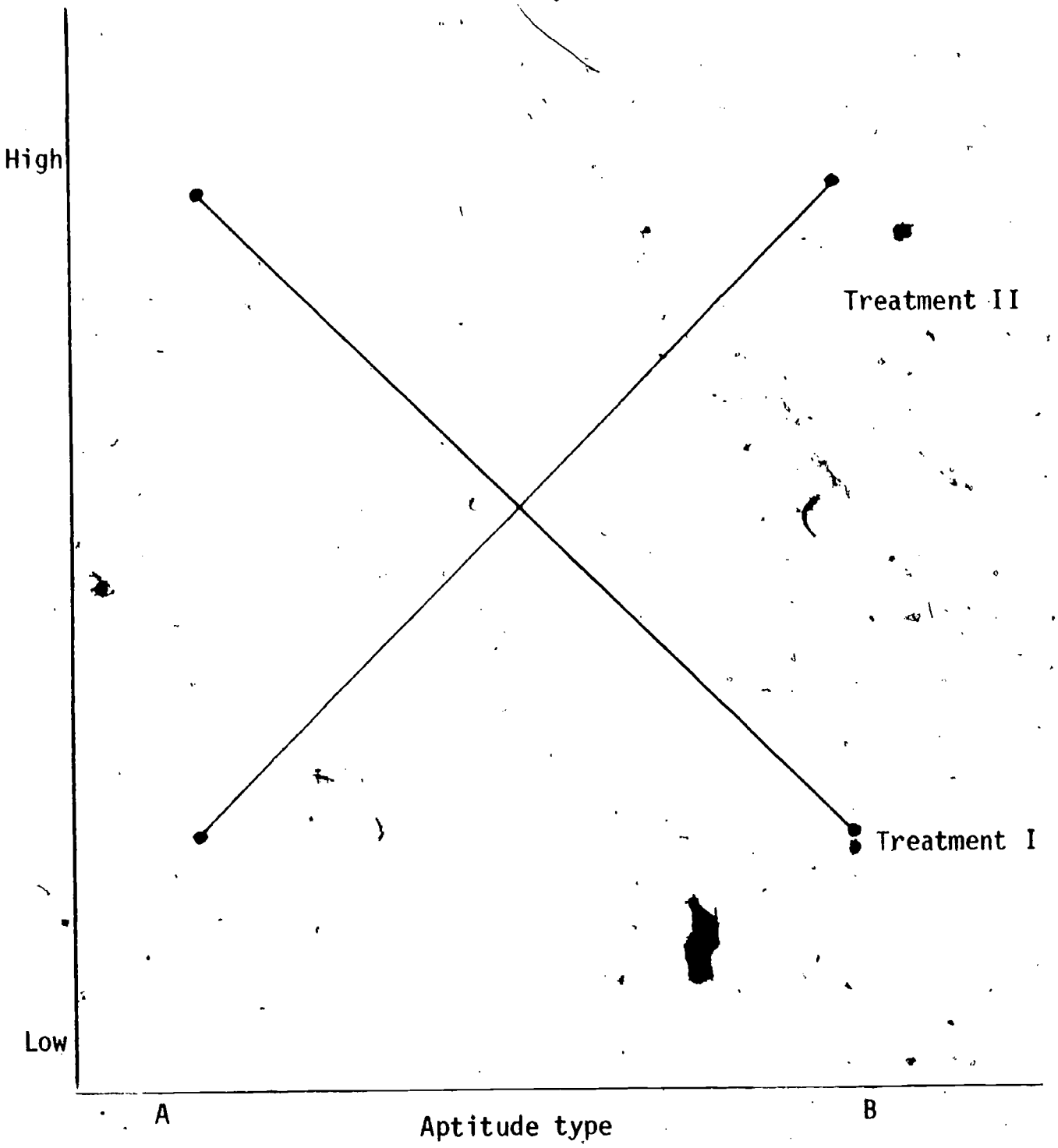


Fig. 1. Example of an aptitude by treatment interaction (ATI).

The teacher or diagnostician begins with some initial student achievement, typically, the performance of a task in a subject-matter area (e.g., reading or mathematic scores). The teacher first must seek to isolate the factors and processes that are responsible for the differences observed in children's performances before instructional treatment can be prescribed. Note that the more heterogeneous the population of concern (in areas relevant to the particular learning task), the more complex is the teacher's work. Although complexity may increase, the importance of the work also increases because to optimize instruction for all learners we must know why each performs as he or she does. In classrooms containing handicapped students, there is likely to be manifested a greater range of learning characteristics and number of relevant characteristics than in classrooms containing more homogeneous groups of students.

Learner characteristics refer to "broadly defined" aptitudes. Snow (1979) defined an aptitude as an individual difference dimension that is related to individual differences in learning or performance. Measures of "intelligence" or "academic ability" exemplify aptitude constructs (i.e., aptitude "narrowly defined"). However, any individual difference construct that is related to learning (e.g., measures of cognitive style, special ability, personality, or interest) defines aptitude. Individual differences in learning-task performance are believed to be due to cognitive processes that also underlie individual differences on relevant aptitude measures.

Categories of Learner Differences

In considering the vast constellation of possible learner character-

istics, I have found it useful to expand upon a schema proposed by Weiner and Cromer (1967) and extended by Levin (1977). This framework helps to clarify the ease and course of diagnosis as well as of prescription.

When reading comprehension is used as an example of a desired performance, four sources of differences can be identified. (Some sort of task analytic procedure should be performed initially to isolate the behavioral components of the specific performance: see Gagné, 1974, for a relevant discussion of task analysis).

A particular learner's poor output in a specific area or on a specific task may be due to what Weiner and Cromer called a "defect" but, more appropriately, may be called "malfunction," that is, damage resulting in a condition of malfunction. The condition is considered to be relatively permanent, typically stemming from sensory-physiological factors. Although characteristics in this category are perhaps the most straightforward with respect to diagnosis, remediation typically is beyond the scope and resources of regular classroom instructors. My subsequent discussion therefore, does not include this category of learner differences.

In contrast to the preceding category in which relevant mechanisms are malfunctioning, and another category in which essential processes are absent, we are concerned here with "disruptions," that is, a mechanism that interferes with learning performance. Disruptions may result from motivational and emotional difficulties. The prognosis for remediation of a learner's specific difficulties is quite good when impeding mechanisms fall into this category. In as much as the student's skills are not inadequate, the sometimes lengthy process of skill mastery is avoided. Admittedly, affective problems at times can be difficult to pinpoint clearly and then they may be somewhat resistant to change;

still the long-term prognosis for amelioration is encouraging.

Another category of learner differences is comprised of "deficiencies," each of which, as previously mentioned, is characterized by the absence of some essential function. Deficiences can center on prior knowledge, technical skills related to a particular performance, or one or more elementary processes which, in turn, may be manifested in various distinct performances. Knowledge would include, for example, relevant vocabulary; technical skills would include behaviors such as deriving meaning from printed messages. Basic processes include encoding, rule abstraction, rule application, retention, and retrieval. Note that the distinction between technical skills and basic processes may not always be easy to make because these skills are manifestations of a subset of basic processes in a particular skill area. Also included in this category are metacomponents (Sternberg, 1980) or executive control processes (Rohwer, Rohwer, & B-Howe, 1980). Attentional processes also fall into this category. Whereas instruction in specific knowledge and technical skills has gone on since the first learners and teachers were brought together, formal or systematic instruction in basic or more elementary processes is a newer enterprise. Research findings on the usefulness of information-processing diagnosis for training purposes are promising (Brown & Campione, 1977; Butterfield & Belmont, 1977; Feuerstein, 1979: Sternberg, in press; cf. also Graves in this series).

The final category of learner differences centers on a "difference" between an individual's preferred mode of processing and the optimal mode for the situation of interest. This category includes all learner differences commonly referred to as personality, learning style, and cognitive style dimensions. When translated to performance inadequacies, these differences result from mismatches between the individual learner's preferred mode of processing information and particular task demands. Thus,

although the stylistic variables do not relate to the quality of performance "out of context," they become "deficiencies" when the individual is not able to effectively master a specific skill or a set of information in a manner required by the specific demands of the particular task. An example of an important "difference" is a global-processing preference versus a preference for analysis of detail. The ease with which learners can be trained to use less preferred modes merits systematic examination.

An important point to note is that I am not suggesting that some learners are deficient, different, or disruptive. Rather, I am proposing that a particular learner's performance in a particular situation may be explained by an underlying task-related deficiency, disruption, or mismatch between preferred processing style and specific task demands. In another task, an entirely different set of strengths, limitations, and style preferences may be seen. Thus the strengths and other characteristics can only be defined in a particular learning context.

The manner in which a task analysis of a particular learning performance can be coupled with knowledge of the important categories of learner differences to help isolate relevant learner characteristics was illustrated by Levin (1977). For example, he translated the analysis of reading into a set of four questions which, when answered "yes" or "no," indicates the correct assumption which should be made about a child. The questions are, "Is the student perceptually and mentally capable of reading?" "Does the student attend to the task?" "Can the student identify individual words and word meanings?" "Does the student organize individual words, phrases, etc.?" If the answer to the first question is "no," then an assumption of defect must be made; if the answer to the second question is "no," then an assumption of disruption must be made; "no" to the third question, indicates an assumption of deficiency, and "no" to the fourth, an assumption of difference (see Levin, 1977, p. 119, Fig. 5-2).

Examples of Each Category

Further discussion of each category and examples of how instructional treatments or situational variables are matched with learner characteristics to enhance learning provides a broader understanding of the range of relevant psychological processes. Prospective teachers must be aware of these processes in order to use learners' attributes to enhance their performances. (Many useful suggestions came from the work of Levin, 1977.)

Disruptions. Disruptions may be remediated by providing new information, additional incentives for learning, or more interesting material. New information, transmitted by alternative modes of presentation, may be particularly helpful when disruptions are the result of fear or anxiety. Processing strengths can be used to help to eliminate disruptive behavior so that processing weaknesses can be remediated (i.e., training in less preferred learning modes). Individualized reinforcers (cf. Morreau in this series) should be considered when motivational problems are apparent or suspected. Although, clearly, teachers always try to make instruction interesting, consistent and/or widespread distractability or lack of attention among learners should signal the need for change. For example, varying psychophysical stimulus properties or increasing the relevance of examples can work wonders. In addition, disruptions may be remediated by effecting a better match between students and classroom environment and/or instructional strategy.

Deficiencies. The sequencing of materials clearly is important in the teaching of knowledge and skills, as are a number of curricular variables whose usefulness depends upon the characteristics of the material to be learned. When deficiencies result from lack of relevant prior knowledge, a teacher's charge is relatively straightforward. Nevertheless, teachers would do well to be mindful of situational variables that can enhance learning.

Elaboration training and other learning strategy components may be particularly helpful in remediating skill and process deficiencies. (See O'Neil, 1978, for examples of training approaches and paradigms.)

So far, remediation has been discussed as the sole instructional objective. Levin (1977) noted the importance of considering intermediate prescriptions for some learners, that is, capitalizing on processing strengths or compensating for weaknesses. Such intermediate goals often are necessary because they help to establish motivation for learning, provide avenues for learning, and "buy time" for remediation to take place. Capitalization involves presenting material in a format or modality that is consonant with the student's preferred mode of learning, that is, capitalizing on processing strengths. At the same time, remediation can be attempted by offering portions of instruction in alternative modes. Typically, compensation requires the simplification of materials in some way to minimize the deficient skills or processes (O-Mason & Raison in this series).

Differences. To the greatest extent possible, teachers should be trained to recognize and help students to benefit from the use of learning styles or true "differences." We define such differences as alternative modes of learning and processing information. One might feel there are two classes of differences. One class would include those dimensions in which placement along different points of a particular difference (i.e., style) dimension results in alternative but equally proficient modes of learning and processing information. Possible examples include global versus analytic strategy preferences, and a preference for verbal versus visuospatial elaboration.

A second class of differences include dimensions wherein one end of the particular style continuum is nearly always better than the other end in that individuals who fall on one end always demonstrate enhanced learning or

performance than students on the other end. Note that any style dimension can become a deficiency under instructional conditions that are not adaptive. Instructional prescriptions would differ for the two classes of differences. The first class of dimensions lend themselves to capitalization. That is, the teacher would do well to adapt instruction to these differences to the greatest extent possible. With respect to the second category of differences, the teacher may want to remediate processing weaknesses, and thus, treat these differences as deficiencies (e.g., through teaching note-taking to students with poor listening skills).

While considerable elaboration would normally be required for each of the four categories of learner differences noted, a wealth of relevant information has already been provided in other modules in this series. Rather than duplicate the content of these other units, the most directly relevant modules are cited below under the appropriate general category of difference:

"Malfunctions"

Birch, J. W. Variables in Exceptionality: The Meaning of Exceptionality and the Nature and Scope of Special Education.

"Disruptions"

Bents, R., Lakin, K. C., & Reynolds, M. C. Class Management; Boy, A. V. Psychological Education: Instructional Approaches for Teachers; Del Polito, C. M. Communication Skills for Teachers; Johnson, D. W., & Johnson, R. T. Promoting Constructive Student - Student Relationships Through Cooperative Learning; Morreau, L. Behavior Modification Skills for Teachers; Sprinthall, N. A., Counseling Skills for Teachers; and Wood, F. A. Formal Observation of Students' Social Behavior.

"Deficiencies"

Allen, J., Clark, F. Gallagher, P., & Scofield, F. Classroom Strategies for Accommodating Exceptional Learners; Brolin, D. Life Skills Education; Graves, M. F. Classroom Teacher's Role in Reading Instruction in the Intermediate and Secondary Grades; Hofmeister, A. M., & Preston, C. N. Curriculum - Based Assessment and Evaluation Procedures; and O'Connell-Mason, C.Y., & Raison, S. B. Curriculum Assessment and Modification.

"Differences"

Allen, J., Clark, F., Gallagher, P., & Scofield, F. Classroom Strategies for Accommodating Exceptional Learners; Birch, J. W. Variables in Exceptionality: The Meaning of Exceptionality and the Nature and Scope of Special Education; and Henderson, R. W. Teacher Relations with Minority Students and Their Families. In addition the reader will find four relevant articles appended at the end of this module: Carroll, J. B., & Maxwell, S. E. "Individual Differences in Cognitive Abilities"; Messer, S. B. "Reflection - Impulsivity: A Review"; Witkin, H. A., Moore, C. A., Goodenough, D. R., & Cox, P. W. "Field - Dependent and Field Independent Cognitive Styles and Their Educational Implications"; and Davidman, L. "Learning Style: The Myth, The Panacea, The Wisdom."

Development

Another important source of learner differences that warrants discussion is developmental level. It is well-documented that for instruction to be maximally effective it must be matched -- or optimally mis-

matched -- to the learner's existing cognitive organization (Case, 1978a, 1978b). Cognitive structures are believed to undergo ontogenetic change throughout the lifespan, with the result that an individual is most sensitive to certain types of learning materials and forms of logic during particular developmental periods. Given that developmental differences may be sources of "deficiency" in a nonadaptive setting, it would be productive to consider developmentally related characteristics as avenues for the matching of students to instructional variables. That is, just as students have limitations in unfamiliar forms of logic, so they have strengths in other forms of cognitive organization.

An individual differences approach to learning and development helps prospective teachers to understand the intimate relation between developmental mechanisms and processes of learning (Case, 1978a, 1978b). Development constrains, to an extent, the learning of material that requires cognitive structures which are not present in the learner's current cognitive make-up. Teachers must be aware of the cognitive process prerequisites when performing task analyses prior to teaching skills and processes. A more detailed treatment of the major developmental periods is given in the following sections. Material is organized around a lifespan format.

Infancy

Infant development is marked by a series of milestones or accomplishments in reflexes, locomotion, behavioral states, cognitive behaviors, and personality or social functions. Each category will be considered in this section.

Reflexes. The reflexes of the newborn are summarized in the following table.

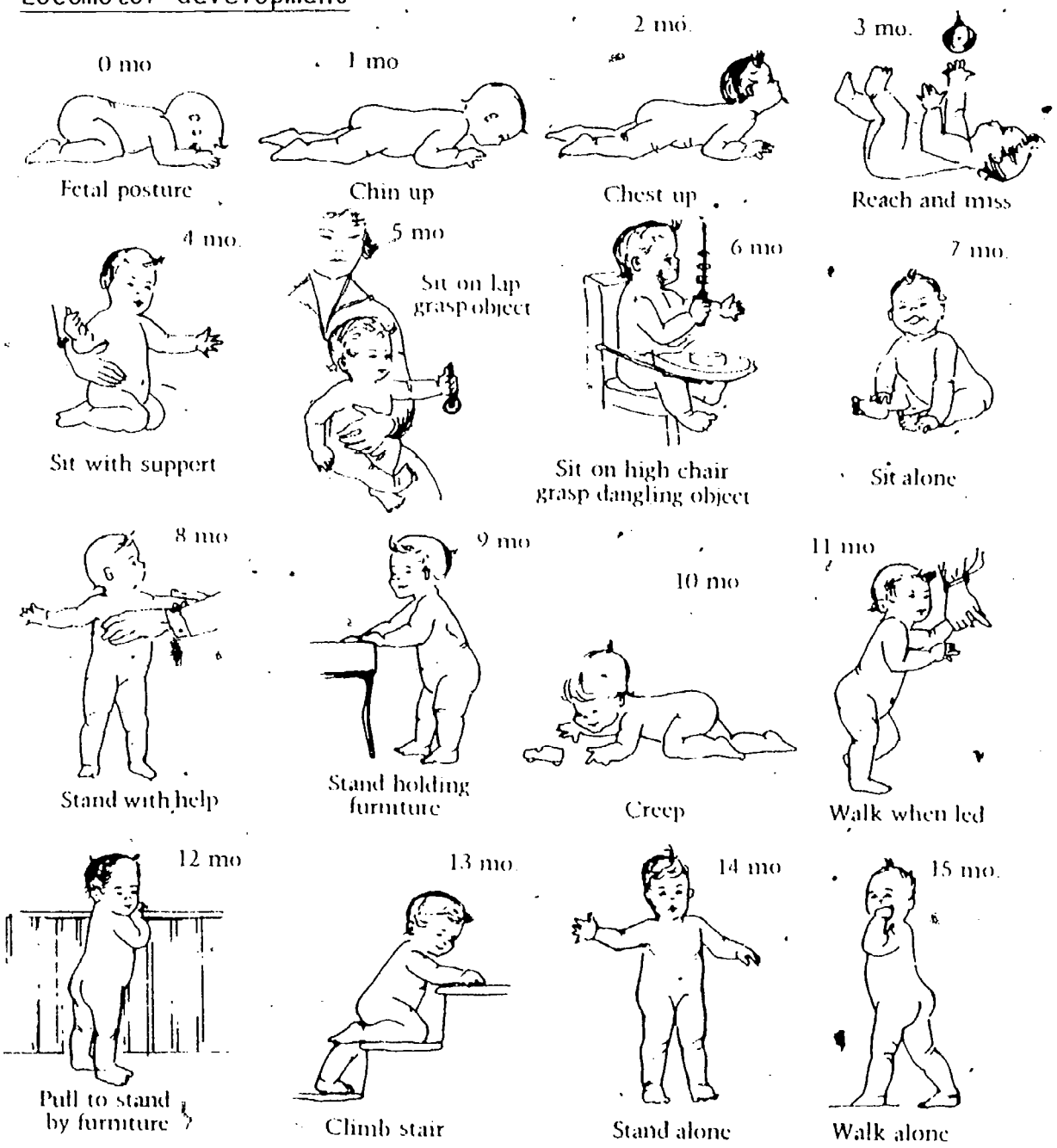
Reflexes of the newborn

Effective stimulus	Reflex
Tap upper lips sharply	Lips protrude
Tap bridge of nose	Eyes close tightly
Bright light suddenly shown to eyes	Closure of eyelids
Clap hands about 18 inches from infants head	Closure of eyelids
Touch cornea with light piece of cotton	Eyes close
With baby held on back turn face slowly to right side	Jaw and right arm on side of face extended out; the left arm flexes
Extend forearms at elbow	Arms flex briskly
Put fingers into infant's hand and press his palms	Infant's fingers flex and enclose finger
Press thumbs against the ball of infant's feet	Toes flex
Scratch sole of foot starting from toes towards the heels	Big toe bends upward and small toes spread
Prick soles of feet with pin	Infant's knee and foot flex
Tickle area at corner of mouth	Head turns toward side of stimulation
Put index finger into mouth	Sucks
Hold infant in air, stomach down	Infant attempts to lift head and extends legs

SOURCE: Mussen, H. P., Conger, J. J., Kagan, J., & Geiwitz, J. Psychological development: A life-span approach. New York: Harper & Row, 1979.

Locomotion. The development of locomotion during the first 15 months of life is depicted below.

Locomotor development



Rolling over from front to back and from back to front are not included on this chart. Considering the muscles that would be used in these maneuvers, where would you place them?

SOURCE: Schickendanz, J. A., Schickendanz, D. I., & Forsyth, P. D. Toward understanding children. Canada: Little, Brown & Company, 1982.

Behavioral States. The following table summarizes major behavioral states of the newborn.

Behavioral States in the Newborn

State	*Motor Activity*	*Muscle tone*	*Skin*	*Eyes*	*Face*	*Respiration*	*Vocalization*
Regular sleep	No movement of limbs and trunk; startle reflexes present	Relaxed	Pink, but pale	Closed; no movement	Relaxed	Regular, breaths 36 per minute	
Irregular sleep	Movement of trunk and limbs between periods of rest	Moderate degree of tension	Flushed during activity	Closed, but movements present	Grimaces such as smiles and frowns	Irregular rhythm; 48 breaths per minute	
Drowsiness	More movement than during regular sleep but less than during irregular	Moderate degree of tension		Eyes open and close; dull, glazed and unfocused		Generally regular	Occasional high pitched squeal
Alert inactivity	Inactive	Moderate degree of tension		Eyes are open, bright, shining, attentive, eyes move together in horizontal & vertical plane		Faster than during regular sleep	
Waking activity	Activity occurs in spurts	Higher degree of tension	Flushed during activity	Eyes are open, but not bright and shining		Irregular	Moans, grunts, whining, but no sustained crying
Crying	Very active	Considerable tension	Flushed bright red	May be open or closed; tears in some babies	Grimaces	Fast and irregular	Crying

SOURCE: Wolff, P. The causes, controls, and organizations of behavior in the newborn. Psychological Issues 5 (1966), Whole No. 17, 1-105. Reprinted from Schickendanz, J. A., Schickendanz, D. I., & Forsyth, P. D. Toward understanding children. Canada: Little, Brown & Company, 1982.

Cognitive Milestones. Papalia and Olds (1978) provide a useful summary of the cognitive milestones experienced during infancy in their overview of Piaget's sensorimotor period of development. This overview is

given below.

Sensorimotor Stage (birth to about 2 years)

In the sensorimotor stage, an infant changes from a creature who responds primarily through reflexes to one who can organize sensorimotor activities in relation to the environment. Babies' activities are organized, not random. Through actively manipulating objects, they progress from reflexes to trial-and-error learning to solving simple problems. They become more goal-oriented and differentiate themselves from their surroundings -- all before the age of 2.

Baldwin (1968) has described the major acquisitions of the sensorimotor period as:

1. The ability to understand that the information received from the different senses relates to the same object rather than to different unrelated ones (Children do not at first associate the tinkling music they hear with the music box on the table; they consider these two completely unrelated aspects of their environment. They have to learn that they can see, hear, and touch the same object.)
2. The capacity to recognize that the world is a permanent place whose existence does not depend on the child's perceiving it (This is the schema of the permanent object discussed below.)
3. The ability to exhibit goal-directed behavior (To get something, a baby performs several different actions and constructs new actions never before attempted. Since these actions are very concrete, a baby's ability to plan ahead is limited.

The schema of the permanent object (Piaget, 1952) is the most important acquisition of the sensorimotor period. The permanent object is one that exists even though the child cannot see, feel, hear, taste, or smell it. If an object is taken away and if the child begins to search for it even after it can no longer be perceived, she or he has a schema of the permanent object. If the child does not seem to remember the object's existence, this schema has not been attained. The schema of the permanent object is basic to the understanding of such vital concepts as space, time, and causality; for unless children understand that objects in the environment are separate from themselves, they cannot truly appreciate the nature of things as they are. "[T]he person who believes that his wishes influence the movements of things, does not understand either self or things; the person who believes that the two are separate has a greater understanding of both" (Ginsburg & Opper, 1969, p. 68). We will trace the development of the schema of the permanent object as we discuss the six substages of the sensorimotor phase.

Substages of Sensorimotor Stage

Stage 1: Use of reflexes (birth to 1 month)

Reflexes are adaptive in that they enable infants to survive and learn. Intelligent reflex behavior forms the basis for later intelligent activity as children change from passive recipients of stimulation that elicits the reflex to active seekers of stimulation.

Stage 2: Primary circular reactions/the first acquired adaptations (from 1 to 4 months)

The baby blissfully sucking a thumb exemplifies a primary circular reaction, an active effort to reproduce something first achieved by chance. The actual content of the behavior, ~~the ability to suck, is inborn.~~ One day she put her thumb in her mouth, exercised her inborn reflex by sucking it, and liked it. Then she made some acquired adaptation: deliberate efforts to put her thumb in her mouth, keep it there, and keep sucking it -- not for food, but just for the fun of sucking. She actively seeks to nourish this schema.

The baby now starts to coordinate sensory information. He looks at, listens to, and touches his sister. He coordinates vision and grasping. When he hears her speak, however, he does not try to look at her unless he has just seen her face in motion (Beard, 1969).

Object permanence: In stages 1 and 2 a baby is constantly encountering, losing contact with, and reencountering objects -- a pacifier, father's finger, mother's blouse. But when something disappears, the baby does not look for it. It has ceased to exist when it cannot be seen, felt, heard, smelled, or tasted. There is no object permanence in these stages.

Stage 3: Secondary circular reactions (4 to 8 months)

This is the beginning of intentional action. An infant who used to repeat primary circular reactions for the joy of the actions themselves is now interested in results. New patterns of behavior continue to occur accidentally during random movement; babies learn the patterns and then repeat them to see what results they will bring. Infants in this stage no longer focus only on their own bodies but are concerned with external objects and events. For example, they now shake a rattle -- not just for the movement, but to hear the noise it produces. They babble -- not just for fun, but to get a response from their parents.

Object permanence: Babies in this stage still do not have the schema of the permanent object. The will look for an object -- say a bottle -- or will kick and scream for it if they see any part of it. If it is hidden entirely, though, they will forget about it and act as though the bottle no longer exists.

Stage 4: Coordination of secondary schemata and their application to new situations (8 to 12 months)

Infants can now solve simple problems by using previously mastered responses. Their actions are increasingly goal-directed. Piaget (1952, p. 219) shows his daughter overcoming the obstacle of his hand:

At 0;8(8) [8 months, 8 days] Jacqueline tries to grasp her celluloid duck but I also grasp it at the same time she does. Then she firmly holds the toy in her right hand and pushes my hand away with her left. I repeat the experiment by grasping only the end of the duck's tail; she again pushes my hand away.

Object permanence: In stage 4 infants are beginning to develop the schema of the permanent object. At 9 and 10 months, they look for an object behind a screen if they have seen it being hidden. But if the object is moved from one hiding place to another while the baby watches, he or she looks for it in the first hiding place.

Stage 5: Tertiary circular reaction/the discovery of new means through active experimentation (12 to 18 months)

This is the last cognitive stage that does not include mental representations of external events, or thought, and the first stage that includes trying out new activities. Infants still make accidental discoveries of actions that produce pleasing results, but they no longer repeat them exactly. They vary their actions, experimenting to find out how an object, event, or situation is new.

In stage 5 babies for the first time intentionally accommodate to find new solutions for new problems. They try out new behavior patterns to reach some goal, and they learned by trial and error. they vary their actions and cause new results, they are led to new complete acts of intelligence. Piaget (1952, p. 272) describes his daughter:

At 1;2(8) Jacqueline holds in her hands an object which is new to her: a round, flat box which she turns all over, shakes, rubs against the bassinet, etc. She lets it go and tries to pick it up. But she only succeeds in touching it with her index finger, without grasping it. She nevertheless makes an attempt and presses on the edge. The box then tilts up and falls again. Jacqueline... immediately applies herself to studying it...

[She] rests the box on the ground and pushes it as far as possible... Afterward Jacqueline puts her finger on the box and presses it. But as she places her finger on the center of the box she simply displaces it and makes it slide instead of tilting it up. She amuses herself with this game and kept it up...for several minutes. Then, changing the point of contact, she finally again places her finger on the edge of the box, which tilts it up. She repeats this many times, varying the conditions, but keeping track of her discovery: now she only presses on the edge.

Object permanence: Although infants in stage 5 have a schema of the permanent object and can follow a sequence of object displacements, they still cannot imagine movement that they do not see. If you were to put a toy in your hand, put your hand behind a pillow, leave the toy there, and bring out your closed hand, the baby would look for the toy in your hand. It would not occur to her that the toy might be behind the pillow, because she did not see you putting it there (Baldwin, 1968).

Stage 6: The intervention of new means through mental combinations (18 to 24 months)

Babies in stage 6 can picture events in their minds and follow them through to some degree. They can think. This stage represents a great breakthrough, since infants no longer have to go through the laborious process of trial and error in solving new problems. They can now "try out" solutions in their minds and discard those that won't work. They also can imitate actions even after whatever they are copying is no longer in front of them.

Object permanence: This schema is now fully developed. Babies can see a series of displacements, look for an object in the last hiding place, and search for objects they have not actually witnessed being hidden.

Personality and Social Functioning. Personality and social development during infancy are summarized in the following tables.

Nine Dimensions of Infant Temperment

Tempermental Quality	Rating	2 Months	6 Months	1 Year	2 Years
Activity Level	HIGH	Moves often in sleep. Wriggles when diaper is changed.	Tries to stand in tub and splashes. Bounces in crib. Crawls after dog.	Walks rapidly, eats eagerly. Climbs into everything.	Climbs furniture. Explores. Gets in and out of bed while being put to sleep.
	LOW	Does not move when being dressed or during sleep.	Passive in bath. Plays quietly in crib and falls asleep.	Finishes bottle slowly. Goes to sleep easily. Allows nail-cutting without fussing.	Enjoys quiet play with puzzles. Can listen to records for hours.
Quality of Mood	POSITIVE	Smacks lips when first tasting new food. Smiles at parents.	Plays and splashes in bath. Smiles at everyone.	Likes bottle; reaches for it and smiles. Laughs loudly when playing peekaboo.	Plays with sister: laughs and giggles. Smiles when he succeeds in putting shoes on.
	NEGATIVE	Fusses after nursing. Cries when carriage is rocked.	Cries when taken from tub. Cries when given food she does not like.	Cries when given injections. Cries when left alone.	Cries and squirms when given haircut. Cries when mother leaves.
Approach/ Withdrawl	POSITIVE	Smiles and licks washcloth. Has always liked bottle.	Likes new foods. Enjoyed first bath in a large tub. Smiles and gurgles.	Approaches strangers readily. Sleeps well in new surroundings.	Slept well the first time he stayed overnight at grandparents' house.
	NEGATIVE	Rejected cereal the first time. Cries when strangers appear.	Smiles and babbles at strangers. Plays with new toys immediately.	Stiffened when placed on sled. Will not sleep in strange beds.	Avoids strange children in the playground. Whimpers first time at beach. Will not go into water.
Rhythmicity	REGULAR	Has been on four-hour feeding schedule since birth. Regular bowel movement.	Is asleep at 6:30 every night. Awakes at 7:00 A.M. Food intake is constant.	Naps after lunch each day. Always drinks bottle before bed.	Eats a big lunch each day. Always has a snack before bedtime.
	IRREGULAR	Awakes at a different time each morning. Size of feedings varies.	Length of nap varies; so does food intake.	Will not fall asleep for an hour or more. Moves bowels at a different time each day.	Nap time changes day to day. Toilet training is difficult because bowel movement is unpredictable.
Adaptability	ADAPTIVE	Was passive during first bath; now enjoys bathing. Smiles at nurse.	Used to dislike new foods: now accepts them well.	Was afraid of toy animals at first, now plays with them happily.	Obeys quickly. Stayed contentedly with grandparents for a week.
	NOT ADAPTIVE	Still startled by sudden, sharp noise. Resists diapering.	Does not cooperate with dressing. Fusses and cries when left with sitter.	Continues to reject new foods each time they are offered.	Cries and screams each time hair is cut. Disobeys persistently.

Tempermental Quality	Rating	2 Months	6 Months	1 Year	2 Years
Threshold of Responsiveness	LOW	Stops sucking on bottle when apptoached.	Refuses fruit he likes when vitamins are added. Hides head from bright lights.	Spits out food he does not like. Giggles when tickled.	Runs to door when father comes home. Must always be tucked tightly into bed.
	HIGH	Is not startled by loud noises. Takes bottle and breast equally well.	Eats everything. Does not object to diapers being wet or soiled.	Eats food he likes even if mixed with disliked food. Can be left easily with strangers.	Can be left with anyone. Falls to sleep easily on either back or stomach.
Intensity of Reaction	INTENSE	Cries when diapers are wet. Rejects food vigorously when satisfied.	Cries loudly at the sound of thunder. Makes sucking movements when vitamins are administered.	Laughs hard when father plays roughly. Screamed and kicked when temperature was taken.	Yells if he feels excitement or delight. Cries loudly if a toy is taken away.
	MILD	Does not cry when diapers are wet. Whimpers instead of crying when hungry.	Does not kick often in tub. Does not smile. Screams and kicks when temperature is taken.	Does not fuss much when clothing is pulled on over head.	When another child hit her, she looked surprised, did not hit back.
Distractibility	DISTRACTIBLE	Will stop crying for food if rocked. Stops fussing if given pacifier when diaper is being changed.	Stops crying when mother sings. Will remain still while clothing is changed if given a toy.	Cries when face is washed unless it is made into a game.	Will stop tantrum if another activity is suggested.
	NOT DISTRACTIBLE	Will not stop crying when diaper is changed. Fusses after eating, even if rocked.	Stops crying only after dressing is finished. Cries until given bottle.	Cries when toy is taken away and rejects substitute.	Screams if refused some desired object. Ignores mother's calling.
Attention Span and Persistence	LONG	If soiled, continues to cry until changed. Repeatedly rejects water if he wants milk.	Watches toy mobile over crib intently. "Coos" frequently.	Plays by self in playpen for more than an hour. Listens to singing for long periods.	Works on a puzzle until it is completed. Watches when shown how to do something.
	SHORT	Cries when awakened but stops almost immediately. Objects only mildly if cereal precedes bottle	Sucks pacifier for only a few minutes and spits it out.	Loses interest in a toy after a few minutes. Gives up easily if she falls while trying to walk.	Gives up easily if a toy is hard to use. Asks for help immediately if undressing becomes difficult

SOURCE: Mussen, H. P., Conger, J. J., Kagan, J., & Geiwitz, J. Psychological development: A life-span approach. New York: Harper & Row, 1979.

Early Childhood

Early chilhood development is characterized by cognitive and affective milestones that are described in the following section.

Cognition. Papalia and Olds' (1978) discussion of Piaget's preoperational stage, from 2-7 years old, is given below.

Piaget's Preoperational Stage (2 to 7 years)

Preschoolers are smack in the middle of Piaget's second major stage of cognitive development, the preoperational stage. They enter it at about age 2, as they come out of the sensorimotor stage and they emerge from it at about age 7, as it overlaps the concrete operations stage.

The preoperational stage ushers in the symbolic function. Children's thought processes used to be chained to the actual, the present, the concrete. Now thay they can use symbols to represent objects, places, and people, their thinking can dart back to past events, surge forward to anticipate the future, and dwell on what might be happening elsewhere in the present. Mental processes are active, but they are also, for the first time, reflective. Once children enter the preoperational stage, their ability to represent things with symbols enables them to share a symbol system with others.

The Symbolic Function

Before the preoperational stage, children could not yet evoke for themselves -- without external clues -- symbols of persons or events. Now they can. They can think of the mother's voice without actually hearing it or conjure up in the mind the sight of an ice-cream cone. These mental representations are called signifiers, and the objects or events that they represent (mother, cone) are called significates. Signifiers may be symbols (very personal representations that involve visual, auditory, or kinesthetic images which bear some resemblance to the object). Or they may be signs, like words or numerals. Young children think first in symbols and continue to think in them even after they become proficient with language and other socially accepted signs.

We can see that children have the symbolic function when they demonstrate deferred imitation, symbolic play, and language. Deferred imitation explains the mechanism whereby children see something, form a mental symbol of it, and later -- when they no longer see it -- imitate the activity. David, age 3, sees his father shaving. When he goes to nursery school that afternoon, he heads for the housekeeping corner and begins to "shave." He obviously has a mental representation of his father's shaving behavior, or he would not be able to copy it.

In symbolic play, children make one object stand for something else. At 15 months, Jacqueline found a cloth with fringed edges that reminded her of her pillow. She treated it as she would her pillow, but laughed unreservedly. Her laughter is our clue that she knows this peice of cloth is not the pillow (Ginsburg & Opper, 1969).

Preoperational children use language to stand for absent things or events. They therefore have invested words with a symbolic character.

Characteristics of Preoperational Thought

Preoperational children have made such a leap forward from the sensorimotor stage that it comes as a shock to realize how rudimentary their thinking still is, as demonstrated by the following characteristics identitied by Flavell (1963, p.p. 156-162).

Egocentrism Preoperational children cannot take the role of another person; they are limited by egocentrism. When Sarah is asked to describe what a three-dimensional model would look like to someone on the other side of the model, she persistently describes it only from her own point of view. She cannot imagine that someone else would have a different viewpoint.

This egocentrism is especially noticeable in the use of language. Listening to a preoperational conversation is like being in the theater of the absurd. Children may politely wait for each other to finish; they may alternate sentences; and they may stay remotely within the same subject area. But each child speaks without knowing or caring whether the others are interested or even listening. The following conversation between two 4-year-olds is typical of such dual monologues:

Jason: What will we have for supper tonight?
Vicky: Christmas is coming.
Jason: Cake and coffee would be good.
Vicky: I have to do my shopping soon.
Jason: I really like chocolate cake.
Vicky: I think I will buy some slippers and candy.

Centration Preoperational children tend to centrate; they focus on one aspect of a situation and neglect others, leading to illogical reasoning. They cannot decenter. In one of Piaget's most famous experiments, Eric is shown two identical glasses, each one short and wide, each one holding the same amount of water. When asked which has more water, Eric, aged 5 says, "They're both the same," While he watches, the experimenter pours water from one of the wide glasses into a tall, thin one, and asks, "Now which one has more water?" Eric points to the short glass. The experimenter pours the water back and forth several more times, and Eric continues to say the short, wide glass has more water. When asked why, he says, "This one is bigger this way," pointing to the width. Other children say the tall glass contains more water. Children this age cannot consider both height

and width at the same time. They center on one or the other and cannot solve the problem. Because one glass looks larger, they think it is larger; their faulty perception inhibits logical thinking.

Irreversibility Preoperational children are also limited by irreversibility; they fail to understand that the pouring operation can go both ways. If Eric could conceptualize the possiblity of restoring the original state by pouring the water back into the other glass, he would realize that the amount of water in both glasses is the same. He does not realize this; therefore, his thought is illogical.

The Practical Application of these Insights The theories developed by Piaget have vast implications for our understanding of children, especially in the realm of preschool education. While Piaget himself has not applied the theories to education, his followers have made his influence felt.

Educational principles rest largely on the way we see children. Piaget sees them as active, as constantly,building an understanding of themselves and their world, as increasingly more organized, more objective, and more able to handle abstractions. With this view we can shape an educational program that will help children grow and develop (Furth & Wachs, 1975).

The Piaget-inspired changes that have taken place in preschool education in recent years rest on our different understanding of children and of the way intelligence develops. An understanding of Piaget's work helps teachers to decide when and how to present various concepts to children. Teachers can adapt Piagetian tasks for classroom use to teach concepts and to assess students' levels of reasoning ability. Those who recognize children's motivation to learn can provide materials and time to assist students in learning at their own pace. Such teachers make it easier for children to pursue individual interests and do not feel that they have to direct all the interests the children should pursue.

Understanding how children think has ramifications that extend into all corners of their lives. Resneck (1975), for example, has identified some aspects of preoperational thinking in children's thoughts about illness, hospitalization, and surgery. Egocentric preschoolers cannot accept logical explanations for why dinner is late ("I am hungry; so my dinner should be here when I want it") or for why they cannot have a drink ("I am thirsty; so what do I care if the doctor ordered 'nothing by mouth'") or for why the nurse cannot stay ("If I need her, what difference does it make if she has five other patients to take care of?"). Children this age may center upon the length of a needle or the size of an x-ray machine to the exclusion of other properties, including their functions. They cannot understand the reversibility of mending a broken leg and, therefore, see traction not as a healing process but simply as an annoying and uncomfortable procedure. Adults who care for children will be better able to communicate with them and to understand them if they can try to remember that children are not merely small adults, but are, rather, developing organisms who are qualitatively different at different times in their lives.

Cognitive Concepts of Preschool Children

During the preschool years children learn how to deal with such concepts as time, space, causation, judgement of age, and morality. Other concepts that Piaget has studied are seriation (the ability to arrange stimuli according to one or more dimensions, such as shortest to tallest or lightest to heaviest) and classification (sorting stimuli into categories of characteristics, such as color or shape). Piaget has found that such concepts come naturally to children at certain points in their development. Let us look at how Piaget studied the development of these last two concepts.

Seriation

Children show that they understand serial relationships when they can arrange objects in a sequence along one or more relevant dimensions. Piaget (1952) used sticks of different sizes to trace the development of relational concepts. He would give the children a handful of sticks of differing heights and pose several problems. Most children were consistently able to pick the smallest and largest sticks by age 4 or 5. Then Piaget would lay them out in a staircase effect. He would show this to the child, demolish it, and ask the child to reconstruct it. Children 5 or 6 years old could do this, with some difficulty. Younger children accomplished the staircase effect, but only on the top; the bottoms of the sticks did not align.

A child who had passed this test was given another set of sticks of various heights to insert in the series, so that the final result would look something like:

Children 5 or 6 years old could do the initial seraition but could not deal with the inserts. That ability did not come till age 6 or 7. The children's mistakes illustrated the primitive characteristics of preoperational thought. For example, getting the staircase effect on one dimension but not on the other indicated that the child was centering only on one dimension and not seeing all the relevant dimensions of the problem. Not until 6 or 7 years old did children develop a true relational concept that includes the principle of always choosing the smallest or largest stick from the pile to construct an ordered series.

Classification

When children can sort objects into categories according to particular attributes, they demonstrate their perception of such characteristics as color, shape and size, as well as their understanding of the concept of categorization. Verbal ability enters in as they label what they perceive.

Children of various ages were given plastic pieces of different colors and shapes and told to "put together those that are alike" (Piaget & Inhelder, 1959). From the ages of 2-1/2 to 4-1/2 years, the children

made quasi-classification, jumping capriciously from one basis of classification to another. Typically, they would sort some materials by color and others by shape, ending up with one pile of red triangles and circles and another pile of red, blue, and yellow squares. By the end of this age level, the children would sort by one dimension at a time, but only one.

Children 7 or 8 years old and older classified exhaustively. They now were able to deal with several dimensions, or classes, at once, ending up with piles of large red circles, small red circles, large blue circles, small blue circles, large yellow triangles, small yellow squares, and so on.

Personality and Social Functioning. Early childhood personality can be viewed from the perspectives of Sigmund Freud and Erik Erikson. In addition, identification and sex typing are important developmental events that play an important role in the quality of early childhood experiences. Papalia and Olds (1978) provide an excellent summary on the following pages.

The preschool years are critical for the development of personality; during them, children emerge more fully as individuals. Their characteristic ways of relating to people are becoming more pronounced, and they are developing many aspects of the personality that will stay with them throughout life: the conscience that will enable them to make moral judgments of right and wrong, their feelings about themselves, their awareness of their maleness or femaleness, and the degree to which they identify with their parents.

Theoretical Perspectives on Preschool Personality

Freud's Theory: The Phallic (Early Genital) Stage

According to Freud, the primary zone of psychosexual pleasure changes at about the age of 3 or 4, when interest and pleasure become concentrated in the genital area. This stage gets its name from phallus, another term for the penis. Preschoolers are fascinated by anatomical differnces between girls and boys and adults and children; they want to find out where babies come from and learn about the adult sex act. Their conversation is full of "dirty" jokes, although more of these still seem to be centered on the bathroom than on the bedroom.

According to the theory of the Oedipus complex, a 3 to 6-year old boy lavishes love and affection with decidedly sexual overtones on his mother, thus competing with his father for the mother's love and affection. Unconsciously, the little boy wants to take his father's place, but he recognizes his father's power. The child is caught up

by conflicting feelings -- genuine affection for his father, tempered by hostility, rivalry, and fear. Noticing that little girls don't have penises, he wonders what happened to them, and his guilt over his feelings for his mother and father makes him worry that he will be castrated by his father. This is the castration complex. Fearful, he represses his sexual strivings toward his mother, stops trying to rival his father, and begins to identify with him.

The Electra complex is similar to the Oedipus: A little girl desires her father, fears her mother, represses these feelings, and eventually identifies with the same-sex parent.

Freud was specific about penis envy in little girls, saying,

> The first step in the phallic phase...is a momentous discovery which little girls are destined to make. They notice the penis of a brother or playmate, strikingly visible and of large proportions, at once recognize it as the superior counterpart of their own small and inconspicuous organ, and from that time forward fall a victim to envy for the penis [1905, quoted in Schaeffer, p. 16].

According to Freud, a little girl just can't win. If she succumbs to penis envy, she hopes to get one for herself and become a man; if not, she is denying her envy, which could cause adult neurosis. Either way, she develops a sense of her own inferiority, is likely to become a jealous person and turn against her mother, who is responsible for her lack of a penis. Eventually, if the girl develops normally (for a female), she

> gives up her wish for a penis and puts in place of it a wish for a child: and with this purpose in view she takes her father as a love-object. Her mother becomes the object of her jealousy. The girl has turned into a little woman [quoted in Schaeffer, p.19].

In the Freudian paradigm, the very desire for motherhood is the result of penis envy. He claims that a woman's procreative urge is most fully satisfied by the birth of a son, "who brings the longed-for penis with him."

Development of the Superego

By identifying with the parent of the same sex, children actually take the parent's personality into their own. In psychoanalytic terms, this is called introjection:

When the boy introjects his father, or the girl her mother, either child constantly then carries around a conscience, representing the parent's wishes, values, and standards. When the child transgresses, this inner voice reprimands him and makes him feel guilty; it is part of the child's own wishes and values [Baldwin, 1968, p. 367].

The superego is comparable to the conscience. At this stage a child's conscience is rigid. The daughter of parents who value cleanliness

may become so compulsive that she will want to change clothing six times a day. Or a little boy may be tormented by guilt because he fought with a friend, even though his parents do not disapprove of harmless tussling. With maturity, the superego, or conscience, becomes more realistic and flexible, allowing an individual to function according to higher principles while also considering self-interest. Freud says that because girls do not fear castration, they cannot develop as strong a conscience. Yet guilt is more commonly manifested by females than males (Bronfenbrenner, 1960).

Freud's Phallocentrism

We plainly see Freud's belief that the male is the norm and the ideal by which both sexes are to be judged. Freud's original and creative thinking made us aware of infantile sexuality, the importance of our subconscious thoughts and emotions, and the significance of dreams. As he addressed himself to the origins of conscience, the process of internalization, and to many more aspects of emotional and intellectual functioning, he has incontestably expanded our understanding of ourselves. And yet we must look for explanations of sex-related differences in personality beyond the theories of this man rooted in Victorian culture and convinced of male superiority.

Erikson's Theory: Crisis III: Initiative Versus Guilt

Preschool children are still trying to gain and maintain a sense of autonomy. Parental guidance and their new ability to express themselves in words help them. Children at this stage are energetic and are eager to try new things and work cooperatively. They turn from a total attachment to their parents to an identification with them, which comes about partly as a result of Oedipal rivalry and guilt, but more from "a spirit of equality experienced in doing things together" (Erikson, 1950, p. 258).

The basic conflict for preschool children is between initiative, which enables them to plan and carry out activities, and guilt over what they want to do. This conflict is a split between that part of the personality that remains a child, full of exuberance and a desire to try new things and test new powers, and the part that is becoming an adult, constantly examining the child's motives and actions for propriety. Children have to learn how to regulate these aspects of their personalities so that they will develop a sense of responsibility but still be able to enjoy life.

If the superego becomes too strict and leaves too much guilt, children may overcontrol and overconstrict themselves until their personlity has been obliterated. Adults who did not develop initiative during these years may suffer from repression: They may develop psychosomatic illness, paralysis, inhibition, or impotence; they may overcompensate by showing off; or they may become self-righteous and intolerant, concerned more with negative aspects of prohibiting their own and others' impulses than with positive tasks of guiding initiative.

Attachment from Parents

With the development of autonomy and initiative, children detach themselves from their parents. Rheingold and Eckerman (1970) found that

children's readiness to leave their mothers increases regularly with age. For each added month, forty-eight 1-to 5-year-old children went about one-third meter farther away from their mothers. After the second year, the children varied considerably in the distance they were willing to go away.

Where do children go when they leave their parents? They explore new territory, learn new games, and form new relationships. The most significant type of new relationship among preschoolers is between peers. Real friendships with other children and peer influences continue to grow until, by middle childhood, friends are as important as parents, if not more so.

Identification

Identification, the process by which a person acquires the characteristics of a model, is explained in several very different ways, depending on the theorist's orientation. Both Freud and Erikson consider a child's identification with the parent of the same sex as an important event of the preschool years. Kagan (1971) defines identification in learning-theory terms, also seeing it as as important development of the preschool period:

> Identification is, in part, the belief of a person that some attributes of a model (for example, parents, siblings, relatives, peers, and fictional figures) are also possessed by the person. A boy who realizes that he and his father share the same name, notes that they have similar facial features, and is told by relatives that they both have lively tempers, develops a belief that he is similar to his father. When this belief in similarity is accompanied by vicarious emotional experiences in the child that are appropriate to the model, we say that the child has an identification with the model [Kagan, 1971, p. 57; italics in the original].

According to Kagan (1971), four interrelated processes establish and strengthen identification: Children believe that they share particular physical or psychological attributes with the model; they experience vicarious emotions similar to those the model is feeling; they want to be like the model; and they behave like the model and adopt the model's opinions and mannerisms.

Sex Typing

Wendy, at age 5, is playing house with Michael. "I'm the mommy," she says as she cooks and cleans and takes care of her dolls, while Michael puts on a hat and "goes to work." A minute later, Michael "comes home," sits at the table and says, "I'm hungry. Where's dinner?"

These children exemplify the results of sex typing, the process by which children acquire the behavior and attitudes regarded by their culture as characteristically masculine or feminine. Sex typing goes much deeper than this anecdote indicates. It involves the motives, emotions, and values that help us direct our lives from infancy to the grave. Most of us grow up with strongly defined notions of the

behavior, opinions, and emotions that are appropriate for males and females. Children develop these notions very early, and their sex-role patterns remain remarkably stable throughout life (Hetherington, 1970).

How Sex Typing Comes About

Are differences between males and females biological or cultural? Boys and girls are biologically different even before birth, with different reproductive organs, hormonal levels, and skeletal development. Furthermore, they also show many differences in behavior very soon after birth. One line of research attempts to relate the higher activity level in male neonates with greater aggression in boys and men. Another research thrust seeks to determine the effects of hormones at critical periods in prenatal development. Different levels of hormones may predispose males to more aggressive behavior and females to more nurturant behavior. Even if such predispositions do exist, though, their eventual flowering or withering depends in large part on the ways children perceive the sex-oriented values of their culture.

If male and female behavior were unalterably established by nature, we could not have deviant patterns. Mead (1935) reported on three New Guinea tribes. Among the Arapesh, both men and women are "placid and contented, unaggressive and non-initiatory, non-competitive and responsive, warm, docile, and trusting" (p. 56), and nurturant toward children. Among the cannibalistic Mundugumor, "both men and women are expected to be violent, competitive, aggressively sexed, jealous and ready to see and avenge insult, delighting in display, in action, in fighting" (p. 213). The occasional mild man and nurturant woman are social misfits. The Tchambuli tribe has different expectations for males and females, directly opposite to those in most societies: The woman is dominant, impersonal, and hard-working; the man is less responsible, more concerned about personal appearance, and more dependent emotionally.

Other evidence against wholly biological sex typing is drawn from research on persons with genital anomalies. If a child whose sex is ambiguous at birth is dubbed a girl, and later chromosomal or hormonal evidence indicates that "she" is more properly a "he," it will be possible to reassign the child's sex without severe psychological stress only if the change is made before the child is 2 years old (Money, 1963). Otherwise, sexual orientation -- even when contradictory to biological sex -- will be too strongly entrenched to change.

Probably, characteristically male or female behavior is determined by some combination of hormonal and environmental influences. Female guinea pigs whose mothers had received testosterone while pregnant exhibited masculine behavior when they reached maturity (Dantchakoff, 1938); the administration of testosterone to young female rats made them act in typically masculine patterns (Gray, Lean, & Keynes, 1969); and female rhesus monkeys masculinized in utero acted more like males in initiating play, engaging in more rough-and-tumble play, and other activities (Phoenix, 1966).

Animals are not people, of course, and the behavior of human beings is determined socially to an infinitely greater extent than that of any

animal. Furthermore, we cannot confirm animal studies with human beings. We can, though, observe and draw inferences from those occasional individuals in whom sex assignment is not clear-cut. Of particular interest are two studies involving a total of twenty individuals.

Ehrhardt and Money (1967) saw ten girls, aged 3 to 14, who had been born to women who had received synthetic progestins during pregnancy. Nine of the girls were born with abnormal external sexual organs, which had to be surgically corrected to make the girls look normal and enable them eventually to participate in sexual intercourse. Internally, they were females capable of normal reproduction. All were raised as girls from birth and generally looked forward to the role of wife and mother. As children, though, they were closer to the male sterotype. Nine were called "tomboys": They liked to compete with boys in active sports and liked playing with trucks, guns, and other "boys' toys" better than with dolls and other "girls' toys." Tomboyishness is common among middle-class girls, and there is nothing pathological about it. But while acknowledging that tomboyishness "does not preclude eventual romance, marriage, child bearing and full-time home and family care" (p. 96), the authors still raise the possibility that there might be something in fetal masculinization which affects that part of the central nervous system that controls energy-expanding behavior. From an early age, boys are more active than girls. How much of this is hormonal and how much is cultural? We don't know.

The ten people, aged 13 to 30, in the other study (Money, Ehrhardt, & Masica, 1968) looked like females but were chromosomally male. They had testes instead of ovaries and were unble to bear children since they could not ovulate. Their condition appeared to have been inherited; the particular mechanism may have involved an inability to utilize androgen prenatally. Since they looked like normal girls, they had been brought up as females. All were "typically female" in behavior and outlook. They all considered marriage and raising a family to be very important, and all had had repeated dreams and fantasies about bringing up children. Eight had played primarily with dolls and other "girls' toys," and the seven who reported having played "house" in childhood had always played the mother. There was no ambiguity in their psychological sex role. Their experiences and attitudes show the strong influence of environment on sex typing.

In most cultures men are more aggressive and have more authority than women, and they usually do the dangerous, physically strenuous jobs, while the women generally perform routine jobs closer to home. These patterns grew up because of anatomical differences. The average man is taller, heavier, and more muscular than the average woman, and the woman bears and nurses the babies. Today, however, most work in an industrial society can be performed as well by a 90-pound woman as by a 200-pound man, and women are bearing fewer children and nursing them more briefly, if at all. The old bases for assigning work along sex lines do not seem so relevant.

In the cognitive-developmental theory, sex typing comes about as a natural corolary of cognitive development. First, babies hear and learn the words "boy" and "girl"; then they are labeled as one or the other; and by the age of 2 or 3, they know the appropriate labels for

themselves and begin to organize their lives around these labels. While children are learning what they are, they are also learning what to do. They learn what activites, opinions, and emotions are considered masculine or feminine and they incorporate the appropriate ones into their daily lives.

As cognitive development progresses, children think in terms of cross-cultural stereotypes, which "are not derived from parental behavior or direct tuition, but rather, stem from universally perceived sex differences in bodily structure and capacities" (Mussen, 1969, p. 411). When they notice the differences in male and female body structure and capacities, they consider dominance and aggression as male characteristics and nurturance as a female trait. They try to live up to these stereotypes, as well as trying to copy directly the attitudes and activities of individual adults of the same sex.

Middle Childhood

With the expanding social and cognitive environment occurring in middle childhood, we see a wealth of diversity among children during that time. The major cognitive milestones are described by Mussen et al. (1979) in the following summary.

Cognitive and Personality Development.

The Stage of Concrete Operations (Ages 7-12)

There are several important differences between children in the preoperational stage and those, age 7 and older, who have reached the stage of concrete operations. An operation, in Piaget's terms, is a mental routine that transforms information for some purpose. Examples are mathematical operations -- adding two numbers to get a third -- and classification schemes -- putting all spotted objects together. The differences listed below reflect mental operations that older children can perform and a preoperational child cannot.

Mental Representations. One major difference between the preoperational and the operational child is that the younger child cannot create a mental representation of a series of actions. The 5-year-old can learn to walk four blocks from her home to a neighborhood store, but she cannot sit at a table with pencil and paper and trace the route she takes. She does not have a mental representation of the entire sequence of movements; she walks to the store successfully by making correct turns at certain places along the way, just as a rat runs a maze, but she has no overall plan or cognitive map.

Conservation. One of Piaget's most notable contributions to developmental psychology has been his investigations of the concept of conservation, another mental operation that emerges around the age of 7. "Conservation" is used in the sense of something that does not change

in spite of other transformations. For example, suppose we show you a ball of clay, then hammer it into a pancake shape; has the amount of clay been changed? Obviously not. But children under 7 are likely to answer "Yes," because the pancake looks like less than the ball. Similarly, if a 5-year-old is shown two identical glasses of water and then watches as one is poured into a wider glass, so that the water level does not rise as high, she is likely to say that now the amount in the wider glass is less than that in the narrower glass. She cannot consider all the dimensions simultaneously -- height and width -- nor can she mentally reverse an action -- "If you poured it back, it would be the same again." She cannot perform the mental manipulations necessary to understand the concept of conservation of amount.

The preoperational child has trouble with the notions of conservation in many dimensions. If two sticks of equal length are placed side by side so that their endpoints coincide, all children will admit they are equal. If one stick is moved forward an inch, the average 5-year-old will say that it is now longer, while the 7-year-old will acknowledge that they are still the same length. Similarly, the preoperational child does not appreciate the fact that if the number of objects in two collections is equal, changing the shape of the collections does not affect the equality in number. If two rows of five buttons are arranged in equal lengths, all children will admit there is an equal number. If one row is then spread out, made longer, the 5-year-old is likely to assert that it now contains a greater number of buttons. The 7-year-old is unimpressed by the mere regrouping.

In general, preoperational children are swayed by appearance: The higher level and the longer the row look like more. Even adults are influenced by such perceptual tricks; witness the manipulations of merchandisers to create boxes that appear to have more of their product than their competitors have, even though the amounts are in fact equal. When the child develops the ability to transform perceptions according to some conceptual rule -- the width of a glass can compensate for the height -- he or she can understand the notion of conservation in the face of obvious change.

Relational Terms. The preoperational child has difficulty with relational terms such as "darker," "larger," and "bigger." She tends to think in absolute terms. A house is big; if compared to a large apartment building, it is still big. Similarly, a brother might be tall, since he is taller than she; he is tall even in the company of adults, for how can a tall person suddenly become short? The comparison of two people, objects, or events is a mental operation that few young children can perform well. After the age of 7, however, these comparisons give adult meanings to relational terms.

Classifications. According to Piaget, the preoperational child cannot think simultaneously about part of a whole and the whole. If a 5-year-old is shown eight yellow candies and four brown candies and asked, "Are there more yellow candies or more candies?" she is likely to say, "More yellow candies." Piaget believes this reply means that the child cannot reason about parts and wholes at the same time.

Serializations. Children who have reached the level of concrete operations can arrange objects on some dimension such as weight or size. The 5-year-old typically cannot arrange eight sticks of differing lengths in a row according to length. Such an ability is probably necessary for understanding numerical relationships of various kinds and, therefore, for the learning of arithmetic.

Personality and social development continue during this period. The development of a positive self-concept and identity are major milestones occuring during middle childhood.

Adolescence

Adolescense ushers in the beginning of adult thoughts and social functioning. Piaget's stage of formal operations is summarized below by Mussen et al. (1979).

The Stage of Formal Operations (Age 12 On)

In this final stage of intellectual development, children begin to function somewhat like scientists. They are capable of thinking abstractly, of generating hypotheses, of spinning a "grand" theory or two. They begin to use systematic, formal routines (formal operations) to evaluate all the possible solutions to a problem. Consider the following question put to a 7-year-old and a 13-year-old: "A man was found dead in the back seat of a car that had hit a telephone pole. What happened?" The younger child thinks up a satisfactory answer and reports it: "The pole knocked the man into the back seat and killed him." The older child generates a host of possible answers "The pole knocked him into the back seat." "He was riding in the back seat when the car hit the pole." "He was placed in the back seat after the crash to make his murder look like an accident." This child is interested in more information, that is, evidence that will enable him or her to reduce the number of plausible hypotheses.

Children who are capable of formal operational reasoning do much better than younger children on tasks that require systematic organization. In games like Twenty Questions, older children can carefully eliminate possibilities and "zero in" on the correct answer, while younger children tend to ask questions that are unrelated to one another and that seem to be asked simply because they occur to the child. Another example of a task in which formal operations greatly aided the problem-solver is one in which children were asked to pair colors. Given six piles of squares of different colors, children were told to make all possible pairs. The older children could generate a rule that would enable them to make these pairings in a systematic way; for example, they might start with one color -- red -- and pair it with each of the other colors -- green, yellow, blue, orange, purple: then they would repeat this process with the second color -- green -- and so on. The younger child might succeed in pairing all colors but only with a laborious trial-and-error routine.

Formal operations are more concerned with the form than the content of a problem, and thus formal-operational thought is less distracted by unusual or impossible elements in a problem. An older child can solve

a problem such as "If a banana can eat two rocks in one day, how many rocks can it eat in three days?" Younger children cannot imagine a banana eating a rock, so they will refuse to solve the problem; they cannot disregard the content of the problem and reason in a purely hypothetical way.

Formal, abstract rules that apply to whole classes of problems, such as those in mathematics, are used to advantage by children in the formal operational stage. Formal thought reflects a generalized orientation toward problem-solving. The basis of this orientation is the tendency to isolate the important elements of a problem and systematically explore all the possible solutions, evaluating each in a rational and objective way. This description sounds like a definition of the scientific method, and it is meant to; formal operations are basic to scientific thinking.

Adolescent children are in a sense budding scientists; they are also in a sense budding philosophers. Intrigued by abstract ideas, adolescents may drive their parents to distraction with their endless debates on the nature of truth and the implications of reincarnation. Older children become capable of thinking about thinking; they can reflect on how they solved a problem -- on the rules and processes they used -- and they can judge the gerneral effectiveness of a procedure for solving problems independently of the solutions it may generate in a particular case. The child in the stage of concrete operations tends to deal largely with the present, with the here and now; the adolescent becomes concerned with the hypothetical, the future and the remote. One adolescent was overheard to remark, "I was thinking about my future, and then I began to think about why I was thinking about my future, and then I began to think about why I was thinking about why I was thinking about my future!" Piaget believes that this kind of preoccupation with thought is one of the prime characteristics of the stage of formal operations.

SOURCE: Mussen, H. P., Conger, J. J., Kagan, J., & Geiwitz, J. Psychological development: A life-span approach. New York: Harper & Row, 1979.

Personality and Social Development. Elkind and Weiner (1978) provide a flavor of the relationship of adolescent and adult traits as seen in the following chart.

Trait Consistencies from Adolescence to Adulthood in the Oakland Growth Study (OGS; ages 12-50) and the Guidance Study (GS; ages 12-40)

	Females		Males	
Items	OGS	GS	OGS	GS
Ways of approaching and processing information:				
esthetically reactive	.85	.60	.76	.80
verbally fluent	.66	.69	.79	.81
wide interests	72	.69	.79	.84
prides self on objectivity	.65	.51	.79	.60
introspective	.57	.70	(.49)	.66
thinks unconventionally	.66	.71	(.27)	.65
ruminative	.54	.66	(18)	.51
has concern about body	(.38)	54	51	51
Forms of interpersonal reactions:				
arouses liking	.60	68	.71	.63
assertive	.69	.76	(.47)	68
socially poised	.76	.72	.67	(.49)
values independence	.69	.63	.50	52
aloof	.74	59	.60	.58
distrustful	.57	(.49)	.55	.56
Responses to socialization influences:				
fastidious	.69	.70	.71	.63
sex-typed behavior	59	.67	.52	.77
rebellious	.70	.75	.61	.73
overcontrolled	.64	.72	.61	79
undercontrolled	.70	.66	.72	.73
pushes limits	.67	.69	.77	64
feels victimized	(47)	52	74	.65

Trait Consistencies from Adolescence to Adulthood in the Oakland Growth Study (OGS; ages 12-50) and the Guidance Study (GS; ages 12-40) (cont.)

	Females		Males	
Items	OGS	GS	OGS	GS
Manner of self-presentation:				
interesting	.74	.77	.62	.65
cheerful	.69	.70	.62	.67
satisfied with self	.57	.70	.57	.67
satisfied with appearance	.67	.55	(.48)	56
talkative	72	.63	65	.68
intellectual level	.80	.78	.87	.86
rapid tempo	.64	.72	(.44)	.62
physically attractive	.73	.69	.60	.67
basic hostility	.62	.66	.63	.56
self-dramatizing	.69	.71	.71	.69
self-defeating	.61	.57	.75	.81
fearful	73	.57	.61	.58
reluctant to act	63	.55	(.40)	67

SOURCE: Haan, N., & Day, D. A longitudinal study of change and sameness in personality development: Adolescence to later adulthood. International Journal of Aging and Human Development, 1974, 5, 11-39.

Elkind and Weiner (1978) underscore the importance of emerging heterosexual interests to the adolescent.

Heterosexual Interests and Dating

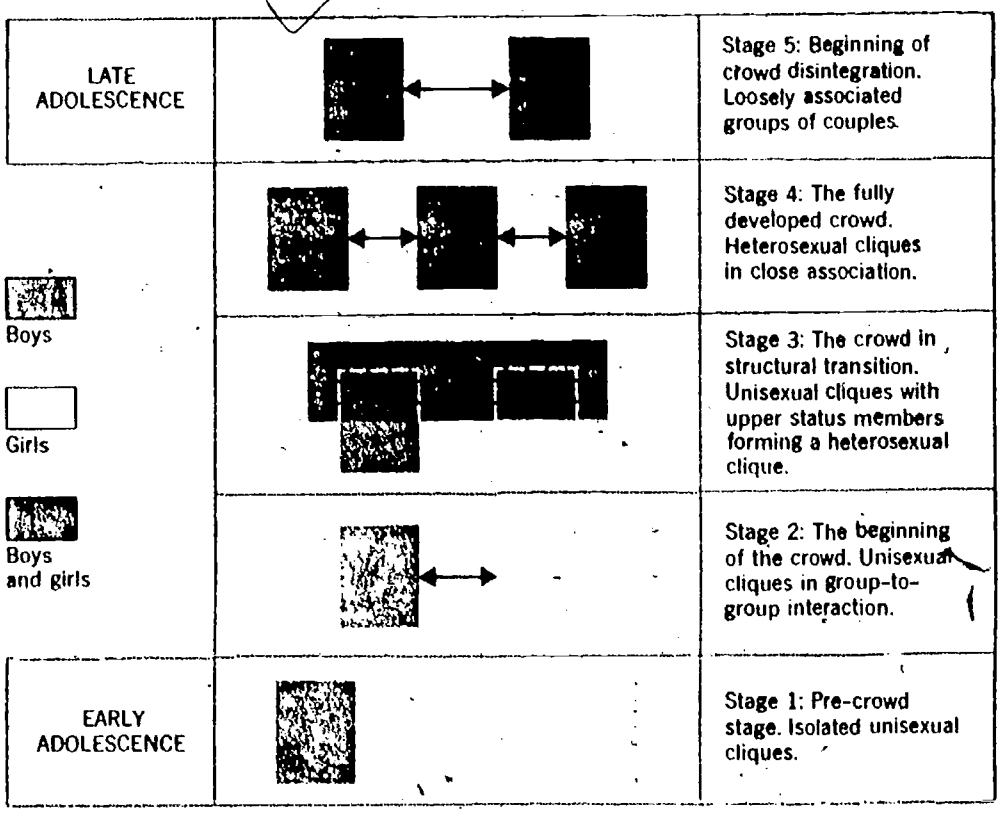
The most significant aspect of interpersonal relationships that emerges during adolescence is an interest in the opposite sex. Three factors contribute to the beginnings of heterosexual interest at this point: (a) the hormonal changes that take place during puberty produce sexual feelings that motivate boys and girls to seek each other's company; (b) adolescents view heterosexual relationships as an aspect of being

grown-up and therefore value them; and (c) parents and peers expect adolescents to be interested in the opposite sex. Parents may have some reservations about when and whom their son or daughter should date, but they are likely to become even more concerned if their adolescent child shows no heterosexual interest.

When adolescents are asked why they enjoy dating, they consistently give one or more of the following reasons: to assert their independence, to gain status, to seek sexual gratification, to have companionship, to participate in dating activities, and -- as they get older -- to look for a "steady" and eventually to find a mate. Despite its attractiveness, however, dating develops slowly through several phases of adolescent group formation, and it brings with it numerous sources of conflict and concern.

Phases of Group Formation and Heterosexual Development.

In a widely cited analysis of adolescent social structure, Dexter Dunphy has charted group formation as depicted in Figure 16.2 (33). At the beginning of adolescence, boys and girls stand apart from each other in the unisex groups that characterize middle childhood (Stage 1). Soon they begin to interact as boy-girl groups (Stage 2), after which they enter a transition period when some boys and girls pair off (Stage 3). Later on, adolescents get together largely in boy-girl pairs (Stage 4), and by late adolescence this pattern is replaced by couples whose closest relationship is with each other and who have only loose associations with other couples (Stage 5).



SOURCE: Dunphy, D. C. The social structure of urban adolescent peer groups. Sociometry, 1963, 26, 230-246. Reprinted from Elkind, D., & Weiner, I. B. Development of the child. Canada: Wiley & Sons, 1978

Specifically what this means is that boys and girls who before adolescence had little to do with one another begin during early adolescence to arrange parties in which they gingerly test the new sensations and feelings that are associated with emerging sexuality. They drink Cokes, listen to records, dance, chase one another, wrestle, and perhaps do some experimental necking in the corner, but strictly in the context of a group activity without any consistent pairing off. Later on they begin dating, which means that their social affairs are for couples who come as a pair and are not just groups of boys and girls. Over time, casual and occasional dating tends to become more frequent dating and then turn into "going steady" or at least narrowing the field to a few serious interests.

Although the sequence of these stages is fairly uniform, the age of transitions from one stage to another varies. Most girls in the United States begin dating around the age of 14 and boys soon after, even though boys at this age may be a year or two behind girls in physical and emotional maturity. Since dating is primarily a social relationship defined by cultural norms and not by biological development, differences in physical maturation appear to have little effect on the age at which adolescents begin to date.

As a cultural phenomenon, however, dating patterns do differ. For example, adolescents in urban areas tend to start dating earlier than those in rural areas, and middle-class youngsters are likely to begin dating sooner than working-class adolescents. Although the latter group begins formal dating relatively late, they soon progress to going steady and getting married, whereas middle-class adolescents tend to do more casual dating before going steady and getting married.

All prospective teachers must have formal exposure to the principles of learning and development. Public Law 94-142 requires these same teachers to be exposed to the characteristics of exceptional students, both developmental and learning.

An individual differences perspective helps prospective teachers to understand exceptionalities within the same framework that is used to understand "nonexceptional" learner characteristics. That is to say, all learner characteristics can be understood as instructionally important individual differences, characteristics that gain their importance because they can be used to enhance learning. The strength of the framework lies in its robustness. Virtually all learner characteristics and, thus, all learners, are in-

cluded.

I am not proposing, of course, that all teachers be trained to recognize and instructionally remediate single-handedly all magnitudes of all characteristics possessed by all learners. Certain characteristics obviously require the added resources of specially trained personnel, both for assessment and prescription. What I propose it that exceptional and nonexceptional characteristics can be best understood by prospective teachers within a unitary framework.

A summary of important categories of learner differences and situational variables in outline form follows. The list is not designed to be exhaustive but, rather, to convey a sense of some of the important constructs which should be included in a course on human development and learning (i.e., psychological foundations of education). The sequence of diagnostic and prescriptive activities is depicted in Figure 2. Throughout this module reference has been made to other modules in this series or other readings that address these activities. Other sources of information about these variables can be found in the extensive bibliography at the end of the module (pages 163-206).

Variables that Affect the Amount and Kind of Learning

I. Learner Characteristics (Intrapersonal Variables)

A. Cognitive (Deficiencies)
   1) Inadequate skills
   2) Deficiencies in relavant prior learning (Knowledge)
   3) Basic Processes

B. Cognitive (Differences)
   1) Personality Dimensions
      a. Introversion-Extroversion
      b. Locus of Control

   2) Cognitive Style Dimensions
      a. Field dependence-independence
      b. Integrative Complexity
      c. Cognitive Complexity
      d. Bandwidth

3) Other Processing Preferences
   a. Holist/Serialist
   b. Parallel/Sequential
   c. Sensory Modality Preferences
      1. Visual
      2. Auditory
      3. Kinesthetic

4) Developmental Level

C. Disruptions
   1. Attentional
   2. Boredom
   3. Lack of Motivation
   4. Anxiety
   5. Aggression

II. Situational Variables

A. Task Requirements
   1) Main Ideas vs. Analysis of Detail/Analysis-Synthesis
   2) Global/Analytic
   3) Recall/Recogntion/Transformation (Application)/Evaluation

B. Classroom Environments
   1) Classroom Climate (Cooperative/Competitive/Individualistic)
   2) Degree of Openess/Structure
   3) Teaching Unit
   4) Ambient Noise
   5) Lighting
   6) Architecture

C. Teacher Characteristics
   1) All of the Cognitive Differences Manifested in Learners

D. Instructional Strategies
   1) Expository
   2) Inquiry/Systematic Inquiry
   3) Discovery
   4) Other Discussion
   5) Taba
   6) Socratic

E. Curriculum and Sequencing
   1) Sequencing of Materials
      a. Order (e.g., concrete to abstract)
      b. Rate of Presentation
      c. Frequency and Positioning of Feedback
      d. Practice (Opportunity)
      e. Programmed Instruction
         1. Linear
         2. Branching

2) Curricular Variables
   a. Continuous Progress
   b. Advance Organizers
   c. Adjunct Questions
   d. Multi-media/Multiple Modality consideration
   e. Quality of Instruction
   f. Mnemonics
   g. Method of Loci
   h. Peg Word
   i. Discourse Analysis
   j. Elaboration
      1. Sentential
      2. Imaginal
   k. Other Learning Strategies or Strategy Components

Some of the style, difference, or personality dimensions are discussed in more detail in the following section, including discussion in accompanying materials regarding the manner in which differences along the various dimensions can be capitalized on to enhance the amount and quality of student learning. More detailed treatment of the role of various situational or instructional dimensions in the teaching/learning process is given in other modules available from the American Association of Colleges for Teacher Education, under the sponsorship of the National Support Systems Project.

Two overview articles are provided on the following pages succeeded by a set of articles describing important learner characteristics falling in the "difference" category. The first of these articles concerns one of two cognitive style dimensions; specifically, reflection-impulsivity. This dimension pertains to the tendency of an individual to respond slowly and accurately as opposed to the tendency to respond quickly, making relatively numerous errors. The next article deals with a second cognitive style dimension, namely field dependence-independence. This dimension pertains to an individual's ability to perceive a figure apart from its embedding context; an object apart from its field or ground. The final article introduces the notion of individual differences in learning style.

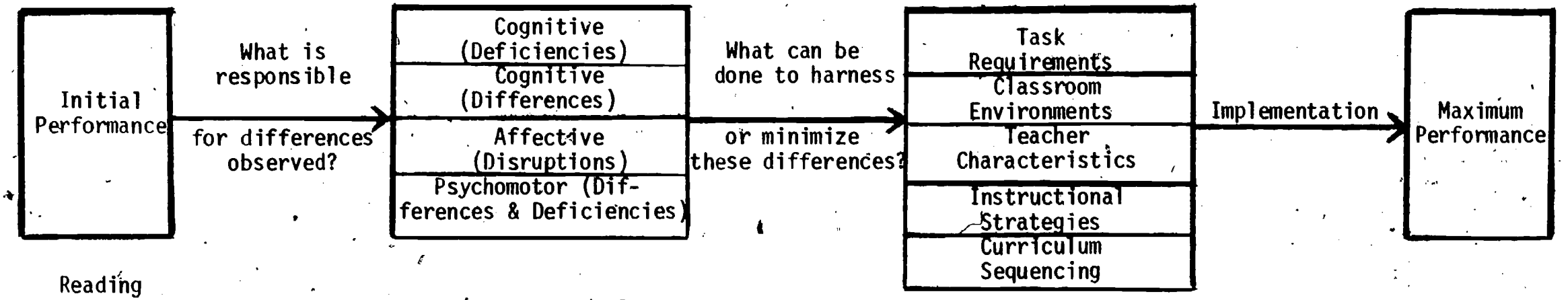


Fig. 2. Relation of learner characteristics to learning performance as a function of situational variables.

A final word of optimism is in order. Although potential teachers must be cognizant of the many relevant dimensions of learner characteristics, they also must be shown the possibilities of successfully applying adaptive instruction. When diagnosis and prescription are successful, the instruction is adapted to the learner, the teaching process is facilitated to a degree that more than offsets initial time spent in inquiry or assessment. Nonadaptive instruction simply does not solve the problems resulting from the magnitude and variety of learner differences. The complexity of the framework described herein is necessary to accurately characterize learners and learning phenomena. All students, normal and handicapped, will benefit if we instruct our teachers in the adaptive principles discussed in this and other modules in this series.

Individual Differences and Public Law 94-142

In a theoretical framework that highlights individual differences, special emphasis has been placed on the significance of Public Law 94-142 in the study of human growth, development, and learning. Thus we have conceptualized, developed, tested, and presented an instructional package that highlights the importance of identifying relevant student characteristics to meet individual needs, particularly those of diverse and exceptional students. We include course content in such areas as characteristics to variations in instruction for exceptional students, special motivational considerations, instructional schedules, instructional media, and instructional modes while stressing an adaptive perspective on exceptionality. In addition, each unit of study contains discussions of the manner in which psychological principles of growth, development, and learning adequately account for the range of human diversity displayed by the broad spectrum of exceptional students. Finally, our laboratory exercises have been

designed to juxtapose normal and exceptional learners, and students must analyze, compare, and evaluate these learners along developmental and cognitive dimensions. An outline of a sample set of laboratory activities follows:

8 2-Hour Laboratory Activities

I. Infancy: Cognitive, Personality and Social Development

A. Cognitive Films - Uzgiris and Hunt Ordinal Scales of Psychological Development, and Brazelton measures.

B. Infant Observation - Students complete actual infant observation, record behaviors, and complete a report, comparing the responses of normal and exceptional children.

C. Affective Film - Origins of Interpersonal Attachments - Students view the development of attachments among various normal and exceptional children, and write a comparative report.

II. Early Childhood: Cognitive Development and Learning

A. Activity - WPPSI, Stanford-Binet, and Piagetian explorations and film. Students view a variety of normal and exceptional students performing cognitive activities, and complete a comparative report.

III. Early Childhood: Personality and Social Functioning

A. Films - Sources of Personality Characteristics, and Early Childhood Personality Development. Students view normal and exceptional children and complete a comparative report.

B. Videotapes - Modeling Aggressive Behavior. Students study early childhood social behaviors as well as affective disorders, and complete an integrative report.

IV. Middle Childhood: Cognitive Development and Learning

A. Films - Development Stages and Processes of Cognition

B. Middle Childhood Observation - Students observe cognitive problem solving on tasks of learning and development among several normal and exceptional children (covering a broad range of exceptionality). Individual differences are addressed in a report in which students must ground their comparative statements in a theoretical model of learning and development.

V. Middle Childhood: Personality Development

A. Films - Students view films depicting personality characteristics and personality development, including coverage of personality disorders during middle childhood. Students complete a comparative report.

B. Observation and Assessment - Students execute informal personality assessments on 7-10 year-old children and compare the responses of these children to adult responses given by their lab partners. Test results must be interpreted in a comparative report.

VI. Middle Childhood: Adolescent Social Functioning

A. Observation and Assessment - Students view psychosocial problem solving among normal and exceptional children ranging from middle childhood through adolescence. Processes investigated include classification of values, sex typing, and moral reasoning. Students complete a report comparing responses within and across age levels, and within and across exceptionalities.

VII. Adolescent - Adulthood: Cognitive Processes and Learning

A. Film - Proportions, Probability, and Combinational Reasoning.

B. Film - Exceptionality during Adolescence and Adulthood.

C. Assessment - Students use lab partners to conduct assessments of various aspects of formal reasoning. Students prepare a report, integrating these findings with lecture material on exceptionality.

VIII. Classroom Management

A. Activity - Students develop a self-management program

B. Activity - Students develop instructional media and conceptualize instructional models designed to be optimally matched to the special cognitive or social needs of a particular exceptional learner.

The final section contains a bibliography of supplementary readings on human development and learning from an individual differences perspective.

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Individuals and Learning: The New Aptitudes

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In this paper, I propose to show how certain developments in psychology have influenced present educational methods, and to show further how recent work in learning theory, developmental psychology, and psychometrics strongly suggests new directions for educational research and practice. I shall discuss this theme in the context of a central problem in education—the individualization of instruction or, in other terms, adapting educational environments to individual differences. I shall focus on the education of the young child in the pre-school and elementary school years, although what I have to say seems applicable to all levels of our educational system.

The problem obviously has been a persistent one; it has been recognized and proclaimed at least since the beginning of this century, three generations ago. Very early in the century, Edward L. Thorndike (1911) published a monograph entitled "Individuality." His editor's introduction summarizes the then current situation by noting that the teaching profession and education in general were showing signs of a violent reaction against the uniformity of method that for so long clutched and mechanized the schools. The deadening effects of uniformity needed to be recognized. Parents and students had been the first to notice this; now the professional consciousness was deeply penetrated because the teachers themselves realized that they were caught in the iron machinery of their own making. These turns of phrase were written in 1911, and throughout the twentieth century, the problem has been raised again and again. In 1925, a major effort appeared in the twenty-fourth yearbook of the National Society for the Study of Education entitled "Adapting the Schools to Individual Differences." Carleton Washburne's introduction states in forceful terms that the widespread use of intelligence and achievement tests has made every educator realize that children vary greatly as individuals, and "throughout the educational world, there has therefore awakened the desire to find some way of adapting schools to the differing individuals who attend them (Washburne, 1925)."

Shouts of alarm have been ubiquitous; many suggestions have been made a few sustained experiments have been launched. Nevertheless, it is now 1972, and time goes by with still only a recognition of the problem, and as yet, no directions towards solution realized. This is the situation that I would like to examine. I am encouraged to do so by the fact that work in the study of human behavior over the past 10 to 20 years now points to possible solutions. Unfortunately, I cannot point to new directions in a simple way by listing a few principles that ring with self-evident truth, although this is the fashionable road to current educational reform. The story is complicated, its roots are deep, and its complexities need to be examined.

An analysis of the problem involves the idiosyncracies of two major fields of psychology. As is known, the English and German traditions of the nineteenth century gave rise to two separate disciplines of scientific psychology: psychometrics and experimental psychology. It was the psychometricians with their emphasis on technology who had significant impact upon educational methods. Indeed, the major activity in educational psychology revolved around measurement and psychometric practice. Psychometrics emphasized the nature of individual differences and the utility of measuring these differences for education. Learning variables and modification of the educational environment, however, were not part of this field. Meanwhile, the experimental psychologists went into the laboratory to work on the basic foundations of their science, and concentrated on discovering and formulating general laws of behavior unencumbered by

the additional complication of individual differences. For the most part, individual differences became the error variance in experimental design.

The separation of these two fields, both of which are necessary for a complete conception of instructional theory, led to assumptions about individual differences uninfluenced by knowledge of learning and cognitive processes, and led to theories of learning uninfluenced by the effect of individual difference parameters. In this climate, characterized by the parallel, but not combined, labors of two major disciplines relevant to education, the search for an educational system that responds to individuality has been going on. To be as clear as I can, I will overstate the case by contrasting two kinds of educational environments. One I shall call a selective educational mode, and the other, an adaptive educational mode. It appears that we have produced a selective educational mode while aspiring toward an adaptive one.

A *selective* mode of education is characterized by minimal variation in the conditions under which individuals are expected to learn. A narrow range of instructional options is provided, and a limited number of ways to succeed are available. Consequently, the adaptability of the system to the student is limited, and alternative paths that can be selected for students with different backgrounds and talents are restricted. In such an environment, the fixed or limited paths available require particular student abilities, and these *particular* abilities are emphasized and fostered to the exclusion of other abilities. In this sense, the system becomes selective with respect to individuals who have particular abilities for success—as success is defined and as it can be attained by the means of instruction that are available. The effectiveness of the system, for the designers of the system and for the students themselves, is enhanced by admitting only those students who score very highly on measures of the abilities required to succeed. Furthermore, since only those students who have a reasonable probability of success are admitted, little change in the educational environment is necessary, and the differences among individuals that become important to measure are those that predict success in this special setting.

In contrast to a selective mode, an *adaptive* mode of education assumes that the educational environment can provide for a wide range and variety of instructional methods and opportunities for success. Alternate means of learning are adaptive to and are in some way matched to knowledge about each individual—his background, talents, interests, and the nature of his past performance. An individual's styles and abilities are assessed either upon entrance or during the course of learning, and certain educational paths are elected or assigned. Further information is obtained about the learner as learning proceeds, and this, in turn, is related to subsequent alternate learning opportunities. The interaction between performance and the subsequent nature of the educational setting is the defining characteristic of an adaptive mode. The success of this adaptive interaction is determined by the extent to which the student experiences a match between his specific abilities and interests, and the activities in which he engages. The effect of any election of or assignment to an instructional path is evaluated by the changes it brings about in the student's potential for future learning and goal attainment. Measures of individual differences in an adaptive educational mode are valid to the extent that they help to define alternate paths that result in optimizing immediate learning, as well as long-term success.

A selective educational mode operates in a Darwinian framework, requiring that organisms adapt to, and survive in, the world as it is; an alternative is that the environment can be changed. If we design only a relatively fixed environment, then a wide range of background capabilities and talented accomplishments might be lost from view because of the exclusive reliance upon selection for survival in a particular setting. What is learned and the way in which one learns, and learns to learn, may take on less importance or receive less emphasis in a setting that offers more options for learning.

When one compares a selective educational mode with adaptive educational possibilities, one asks whether the particular selective tests and sorting out devices that are part of present schooling fail to consider abilities and talents that might emerge as important in a more interactive setting where there is room for adjustment between abilities and modes of learning. In principle, and in contrast to traditional practice, there seems to be no reason why educational environments cannot be designed to accommodate more readily to variations in the backgrounds, cognitive processes, interests, styles, and other requirements of learners.

In any educational mode, then, the individual differences that take on outstanding importance are those that have ecological validity within a particular system. In our traditional selective educational mode, the individual differences that are measured in order to make educational assignments center around the concepts of intelligence and aptitude. This bears looking into.

Of the various attempts to measure intellectual ability that began at the turn of the century, Binet's work emerged strongly. It was a practical endeavor to predict school success. The Minister of Public Education in France supported Binet's attempts to determine what might be done to ensure the benefits of instruction to retarded children. It was decided that children suspected of retardation be given an examination to certify that, because of the state of their intelligence, they were unable to profit from instruction as given in ordinary schooling. Scholastic success in an essentially fixed educational mode was the predictive aim toward which this test was directed, for which its items were selected, and in terms of which its overall effectiveness was validated; although to be fair to Binet, his writings do indicate a great deal of sensitivity to

the possibilities for individual differential diagnosis. Nevertheless, the validation of a test is a very specific procedure in which individuals are exposed to particular kinds of test items that are constructed to predict a particular criterion measure. No test is simply valid in general, but for a specific purpose and a particular situation. The concept of Binet's work has persisted, and as Cronbach points out in the 1970 edition of his well-known book on the essentials of psychological testing: "Current tests differ from those of the earlier generation just as 1970 automobiles differ from those of about 1920: more efficient, more elegant, but operating on the same principles as before (Cronbach, 1970)."

At the present time, our most respected textbooks on the subject (Cronbach, 1970; Tyler, 1965) carefully point out that if we base our conclusions about what intelligence tests measure on their most effective use - that is, their predictive validity - then the verdict is that they are tests of scholastic aptitude or scholastic ability; these tests measure certain abilities that are helpful in most school work, as it is conducted in present-day school situations. This same ideology has penetrated the entrance requirements of almost all institutions of higher education (*vide* Wing & Wallach, 1971), and strongly determines the character of primary and secondary school education. It is further to be observed that these tests of scholastic aptitude, when considered over all school levels, account for only 35 to 45 percent of the variation in school performance.

Being aware of this, we have not been remiss in attempting to probe deeper into the different facets of human behavior that might allow us to be more sensitive to individual differences. Some years ago, as a result of some dissatisfaction with the research on the IQ and together with the results of work on multiple factor analysis, there was a de-emphasis of the concept of general intelligence that led to the popularity of tests of differential aptitudes. At that time, in addition to an overall measure of "intelligence" or "general aptitude," schools began to employ tests that provided measures on a variety of factors such as spatial, mechanical, and abstract reasoning aptitudes. More than predicting overall scholastic success, these test batteries attempted to predict differential success in school programs leading to different vocations which appeared to require different aptitude patterns.

In 1964, a careful analysis was done by McNemar of the validity coefficients of certain widely used, multi-test differential aptitude batteries. He argued from his analysis that "aside from tests of numerical ability having differential value for predicting school grades in math, it seems safe to conclude that the worth of the multi-test batteries as differential predictors of achievement in school has not been demonstrated (McNemar, 1964)." McNemar further concluded that "it is far from clear that tests of general intelligence have been outmoded by the multi-test batteries as the more useful predictors of school achievement." In general, a simple, unweighted combination of tests of verbal reasoning and numerical ability predicted grades as well as, or better than, any other test or combination of more specific ability tests; and these tests of verbal and numerical ability were similar to what was measured in group tests of intelligence. More recent evidence reaffirms McNemar's conclusion. For example, a 1971 technical report of the College Entrance Examination Board points out that there is certainly no reason why the Scholastic Aptitude Test (SAT) could not include measures from other domains in addition to the verbal and mathematical skills tested, and that research to identify these other domains has been an enduring concern. Yet, over the 40 years of the SAT's existence, no other measures have demonstrated such a broadly useful relationship to the criterion of college achievement (Angoff, 1971).

All this suggests the following observation: Given the characteristics of our present educational system, certain general measures of the ability to manipulate numbers and words predict, to a limited extent, the ability to emerge victorious from the educational environment provided. However, any attempt to further differentiate specific ability patterns that relate to specific educational programs is, at best, no more successful than the usual general ability measures or intelligence measures. Why is this so, and what does it mean?

One clue to answering this question is to note that tests of general ability, intelligence, and aptitude follow the accepted practice of attempting to predict the *outcomes* of learning in our rather uniform educational programs. These tests make little attempt to measure those abilities that are related to different *ways* of learning. The generally used scholastic aptitude tests are designed for and validated in terms of predictions of the products of learning in a particular setting. They are not designed to determine the different ways in which different students learn best, to measure the basic processes that underlie various kinds of learning, nor to assess prerequisite performance capabilities required for learning a new task.

Psychologists and educational researchers, again, have not been insensitive to this state of affairs, and there has been a recent emergence of concern about the relationships between measures of individual differences and learning variables. To a large extent, this work was heralded by the 1957 book by Cronbach and Gleser entitled *Psychological Tests and Personnel Decisions* and its second edition in 1965. This book was concerned with the development of a decision-theory model for the selection and placement of individuals into various "treatments." The word treatment was given a broad meaning, referring to what is done with an individual in an institutional setting; e.g., for what job an applicant should be trained in industry, what therapeutic method a patient should be assigned, and in education, to which particular education-

al program or instructional method a student should be assigned or given the opportunity to select. This theoretical analysis attempted to show that neither the traditional predictive model of psychometric work nor the traditional experimental comparison of mean differences was an adequate formulation for these practical decisions, including the kinds of decisions required for the individualization of instruction.

Cronbach and Gleser pointed out that aptitude information is useful in adapting to treatments only when aptitude and treatment can be shown to interact. In a non-technical way, this can be explained as follows: Given a measure of aptitude, and two different instructional methods, if the aptitude measure correlates positively with success in both treatments, then it is of no value in deciding which method to suggest to the student. What is required is a measure of aptitude that predicts who will learn better from one curriculum or method of learning than from another. If such measures can be developed, then methods of instruction can be designed, not to fit the average person, but to fit an individual or groups of students with particular aptitude patterns. Unless one treatment is clearly best for everyone, treatments should be differentiated in such a way as to maximize their interaction with aptitude variables.

Following up on this logic, educational psychologists have been active in experimentation and have searched deeply into the literature of their field. The line of investigation has been called the ATI problem (ATI standing for aptitude-treatment interaction). The intent of the work is different from that of the previously mentioned work on differential aptitude testing. In the differential aptitude testing research, emphasis was placed on determining the relationship between measured aptitudes and learning outcomes under relatively fixed educational programs. In the ATI work, the emphasis is on determining whether aptitudes can predict which one of several learning methods might help different individuals attain similar educational outcomes. To be clearer, the earlier differential aptitude work assumed several different educational programs, each one leading to different careers, and attempted to select individuals with respect to their potential success in each program. The ATI work essentially assumes that if within each of these several programs there were different instructional options, then aptitude patterns might predict the option in which a student would be most successful.

Several recent comprehensive reviews report detailed analyses of ATI studies (Bracht, 1969; Bracht & Glass, 1968; Cronbach & Snow, 1969). In a review by Bracht, 90 studies were each carefully assessed for the significance of appropriate aptitude-treatment interactions. The results of his survey are quite striking. In the 90 studies, 108 individual difference-treatment interactions were examined; of these, only five were identified as being significant with respect to the kind of interaction required for the purposes I have outlined. An extensive and thoughtful analysis of many of the ramifications of the ATI problem also has appeared in an informal report by Cronbach and Snow (1969). The report is far ranging, discussing the relationships between individual differences and learning from many points of view. Their conclusion, with respect to ATI research, is similar to Bracht's: few or no ATI effects have been solidly demonstrated; the frequency of studies in which appropriate interactions have been found is low; and the empirical evidence found in favor of such interactions is often not very convincing.

This is an astounding conclusion; it implies that our generally used aptitude constructs are not productive dimensions for measuring those individual differences that interact with different ways of learning. These measures derived from a psychometric, selection-oriented tradition do not appear to relate to the processes of learning and performance that have been under investigation in experimental and developmental psychology. The treatments investigated in the ATI studies were not generated by any systematic analysis of the kinds of psychological processes called upon in particular instructional methods, and individual differences were not assessed in terms of these processes.

Perhaps we should have known all this, and not have had to learn it the hard way because I am reminded of Lee Cronbach's APA presidential address of 1957. In discussing these general concerns, he said: "I believe that we will find these aptitudes to be quite unlike our present aptitude measures." He went on to say, "Constructs originating in differential psychology are now being tied to experimental variables. As a result, the whole theoretical picture in such an area as human abilities is changing (Cronbach, 1957)." I believe that Cronbach was a moment or two ahead of his time in his address 15 years ago. But, I also believe that education and psychology have since moved in directions which make adaptation to individuals in educational settings more likely; research on cognitive processes, psychometric methodologies, deeper attempts at individualization, and the cultural Zeitgeist seem to offer enabling potentials. I shall go on to describe some of this, but first let me recapitulate the question that I am attempting to answer.

The general question takes the form of the following set of questions: (1) How can knowledge of an individual's patterns of abilities and interests be matched to the method, content, and timing of his instruction? (2) How can the educational environment be adjusted to an individual's particular talents; and to his particular strengths and weaknesses as defined in terms of social and personal objectives for education? and (3) The other way around – how can an individual's abilities be modified and strengthened to meet the prerequisite demands of available means of instruction and available educational opportunities?

The implications of my discussion so far appear to support the hypothesis that the human performances that we identify with the words "general ability," "scholas-

tic intelligence," and "aptitudes" have emerged on the basis of measurement and validation procedures in an educational system of a particular kind. These intelligence and aptitude factors have taken on significance because of their correlation with instructional outcomes, and not because of their relationship to learning processes or different educational techniques. Furthermore, since our educational system provides a limited range of educational options for adapting to different individuals, these general abilities override the influence of any more specific abilities that might be additionally useful if alternate ways of learning were available.

The question now is: What *are* these "new aptitudes"? Current lines of research indicate that a fruitful approach is the conceptualization of individual difference variables in terms of the process constructs of contemporary theories of learning, development, and human performance. There is ample evidence to show that we can experimentally identify and influence a variety of cognitive processes that are involved in new learning, and it appears that the analysis of individual differences in performance can be carried out in terms of such processes (Melton, 1967). Some exemplary studies along these lines can be referred to as illustration. For example, it is known that learning to remember a list of words takes place more effectively when the learner is provided with, or provides for himself, some visual or verbal relationship between pairs of words. Presented with the words "boy" and "horse," one pictures a boy riding a horse, or makes up a sentence containing these words. This process has been called "mental elaboration," referring to the fact that individuals recode or transform materials presented to them by elaborating the content. William Rohwer has been particularly concerned with studying the developmental and individual difference aspects of this process. As children grow older, they begin to generate their own forms of mental elaboration; young children, however, profit from being prompted or encouraged in some way to engage in elaborative activity. Rohwer's work suggests that individual differences, related to children's backgrounds, influence the way in which they carry out cognitive processes of this kind. He further implies that since this kind of elaborative activity facilitates learning in general, it would be fruitful to train particular children in such elaborative techniques of learning; and there is evidence that this indeed can be done to extend the capabilities of young learners (Rohwer, 1970a, 1970b, 1971).

In another series of studies related to our work on individualized instruction at Pittsburgh, my colleague Jerome Rosner has studied perceptual processes that appear to be related to basic academic tasks in elementary school. He has studied individual differences in visual and auditory perceptual processes concerned with competence in organizing and extracting patterns of information presented in geometric patterns and in sound combinations. Rosner's work indicates that competence in these processes is differentially related to academic achievement in arithmetic and reading; visual perceptual processes are more related to arithmetic than reading, and auditory processes more related to beginning reading than arithmetic. He has also shown that these processes themselves can be effectively taught to children, and the indication is that the effects of this instruction transfer to specific accomplishment in the beginnings of verbal and quantitative literacy (Rosner, 1972, in press).

Studies such as these support the promise of a line of research on individual differences in terms of cognitive processes. I would urge that studies attempt to identify the kinds of processes required by various tasks, and to characterize how individuals perform these processes. The conditions required to learn the task could then be adapted to these individual characteristics, or the individual might be taught how to engage more effectively in these processes.

Another sign of support for the theme of process concepts as individual difference variables comes from the work on cognitive styles or personality characteristics that influence learning and performance (Kagan & Kogan, 1970). Here, the influence of individual differences in non-cognitive domains on the cognitive processes involved in problem solving is being systematically studied. This includes research on the effects of cultural background on the dominance of visual, auditory, or tactile sense modalities; the relationship between anxiety and the quality of immediate memory; the ability to hold changing images in memory, what personality theorists have called "leveling and sharpening"; and the degree to which an individual pauses to evaluate the quality of cognitive products in the course of problem solving, generally referred to as differences in reflection and impulsivity.

There have been some interesting attempts to modify cognitive style. For example, it has been shown that when first-grade children are placed with experienced teachers who have a reflective style, the children become more reflective during the school year than children who are placed with impulsive teachers (Yando & Kagan, 1968). The practical implication of this for school instruction is tailoring the tempo of the teacher to the tempo of the child so that, for example, the behavior of the impulsive child is influenced by the presence of a reflective teacher model. Another set of studies has investigated the controlling function of covert speech as a self-guidance procedure whereby impulsive children are taught to talk to themselves in order to modify their problem-solving styles (Meichenbaum, 1971; Meichenbaum & Goodman, 1969).

The processes that make up cognitive style are important to consider in the education of culturally disadvantaged children. As we know, early experience in a particular cultural environment provides the child with a set of values and a set of techniques and skills for learning to learn and for processing incoming information. It has been

pointed out that the middle-class child acquires these things so that they are continuous with what will be required of him in school. Whereas, what a lower socio-economic-class child acquires may be discontinuous with what school demands. In a non-adaptive environment for learning, "cultural deprivation" is defined in terms of a set of experiences that establishes a discontinuity between pre-school experiences and school requirements. An obvious example in the conventional school is that, explicitly or implicitly, the school requires the immediate acceptance of an achievement ethic with deferred future rewards, a characteristic most consonant with middle-class values. This discontinuity has a profound effect on the child's behavior towards school and on the school's behavior toward the child. In the adaptive educational environment that I envision, it would be assumed as a matter of course that the values, styles, and learning processes that the child brings to school are of intrinsic worth. These modes of behavior have, in fact, been extremely functional in the child's environment, and an adaptive setting would work with these assets of the child's functioning as a basis for a program of education (Getzels, 1966).

The work and theories of Piaget quite directly support and influence my theme of the importance of modifiable behavioral processes in adaptive education as opposed to notions of relatively fixed intelligence and aptitude. The stages of cognitive development described in the Piagetian theory of intelligence are thought to mark major qualitative changes in the modes of thinking available to the child, and consequently, changes in the kinds of specific learning of which he or she is capable. Adaptive education, as I have indicated, looks at this in two ways: the educational environment accommodates to the existing modes and processes of a learner, and it also can influence these processes through instruction. The stages described by Piaget thus provide individual modes of performance available to different children which would have to be considered in educational design.

Recently, Lauren Resnick and I (1972) carried out a detailed survey on the possible teachability of basic aptitudes and Piagetian processes. In our examination of operational thinking, particularly the acquisition of concrete operations, with which most studies have been concerned, we noted a significant shift, as compared with a few years ago, in the balance of evidence concerning the trainability of these processes. A number of studies have appeared which offer grounds for suggesting the possibility of developing operational thinking through instruction. As we completed this survey, we were struck with the fact that our search for work on the instructability of basic abilities uncovered far fewer studies on the training of psychometrically defined aptitudes and abilities than on the training of Piagetian and related concepts. This raises the question of why the Piagetian definition of intelligence has stimulated so much more instructional research than has the psychometric one.

One answer seems to be that Piagetian theory is not concerned with differential prediction, but with explication of developmental changes in thought structures and the influence of these structures on performance. This emphasis suggests a variety of specific performances on which to focus instructional attention, and also suggests hypotheses concerning the optimal character and sequence of instructional attempts. In contrast, most psychometric tests of intelligence and aptitude consist of items chosen because of their predictive power rather than their relationship to observed or hypothesized intellectual processes. Thus, they offer few concrete suggestions as to what or how to teach. It appears, then, that successful attempts to adapt instruction to individual differences will depend upon a line of research emphasizing process variables in human performance.

There are other forms of evidence which contribute to our definition of the "new aptitudes" or processes for adaptive education. The fact that our concept of intelligence is undergoing significant change is obvious in the work of Piaget and in related work, but different areas of endeavor also show this clearly. There has been intensive activity in the field of comparative psychology on the intelligence of different animal species (Lockard, 1971). What used to be called general animal intelligence, and tested in the old experiments as general problem-solving ability, now appears to be an aggregate of special specific abilities, each ability evolving in response to environmental demands. Animals are "intelligent" in quite different ways that can be better understood in relation to the ecological demands of their particular environments than in terms of the older notion of a phyletic ordering of animals according to their intelligence. For example, because of their environmental demands, wasps are superior in delayed-response problems to Norway rats, and gophers are better at maze problems than horses and other open-range animals. Animals show a great many different talents evolved as adaptations to their different worlds. The older work in animal behavior appears to have over emphasized abstractions like general maze brightness as a criterion behavior for study. More recent work suggests that natural selection affects smaller mechanisms of behavior which permit the individual organism to perfect a behavior pattern adaptive to the detailed circumstances of the situation.

This fact of ecological validity, that is, that the demands of the environment influence behavior quite particularly, is apparent in another interpretation of intelligence. In a recent book on cognitive development by Olson (1970), intelligence is defined as the elaboration of the perceptual world that occurs in the context of acquiring skills with cultural media. Intelligence is developed through mastering and obtaining skill in the specifics of the prevalent media in society. Such an interpretation has been popularized by McLuhan (1964), who points out that we tend to con-

fuse skill in the medium that happens to be ascendent in our own culture with a presumed universal structure of intelligence. In this sense, intelligence is specific to the particular ways in which school subjects can be learned.

The rise of the "new aptitudes" is also forecast by the notion of interactionism whereby accommodative changes in an individual's performance occur in the course of encounters with environmental circumstances. This has been emphasized by such diverse points of view as Piaget's and Skinner's, and currently is well expressed by Bandura in his writings on social learning theory (Bandura, 1969, 1971). We know now that psychological functioning is a continuing reciprocal interaction between the behavior of an organism and the controlling conditions in the environment. Behavior partly creates the environment, and the resultant environment influences the behavior. This is clearly seen in social interaction, for example, where a person plays an active role in bringing out a positive or negative response in others, and in this way, creates, to some degree, environmental contingencies for himself through his own behavior. This is a two-way causal process in which the environment might be just as influencable as the behavior it regulates. The actual environment an individual experiences can be a function of his behavior if the environment is an adaptive one.

Our penchant for a fixed educational mode arises in part from an old-fashioned psychology, from the scientific and social tendency to think in terms of fixed categories of human beings with consistent drives and dispositions (Mischel, 1969). We think this way, rather than in terms of human beings who are highly responsive to the conditions around them so that as conditions change or conditions are maintained, individuals act accordingly. Adaptive educational environments can take advantage of the fact that individuals show great subtlety in adapting their competencies to different situations, if the situation permits such adaptability. Although individuals show generalized consistent behavior on the basis of which we frequently characterize them, this does not preclude their also being very good at discriminating and reacting to a variety of experiences in different ways. The traditional measures of general ability and aptitudes err on the side of assuming too much consistency, and de-emphasize the capability of individuals to devise plans and actions depending upon the rules, needs, and demands of alternative situations. If, in our thinking about individual differences, we make as much room for the capability of individuals to adapt and change, as well as to be stable, and as much room for the capacity for self-regulation and self-development, as well as for victimization by enduring traits, then an adaptive notion of education must follow. An educational system should present alternative environments that enhance the ability of the individual for self-regulation in different possible situations for learning.

So far, I have tried to show that the state of our understanding of human behavior has in some sense precluded a fruitful approach to individualization and adaptive education. For the reasons I have outlined, we have been fixed on an essentially selective mode of education and on the concepts that underlie it. I have also attempted to indicate some directions that have been taken and some milestones that we seem to have passed that appear to make change toward our ideals for adaptive education more feasible than heretofore.

While I have so far stressed fundamental research understandings, progress will not occur by research alone. The design and development of operating educational institutions is also required. Throughout history, science and technology, research and application have forced each other's hands, and mutually beneficial relationships between the two are absolutely necessary for the development of new forms of education. The development effort with which I am most familiar is the work that my colleagues and I at the University of Pittsburgh have been carrying out for some years in the design of elementary school environments that are adaptive to individual differences. This work has been described and disseminated in a variety of ways (Bolvin & Glaser, 1971; Cooley, 1971; Glaser, 1968; Lindvall & Cox, 1969; Resnick, 1967). Now is not the time to go into it further, although I should say that we have had the privilege and opportunity not only to work with schools, but also to study and evaluate our efforts so that we might move in successive approximations toward understanding what an adaptive educational environment is, how it can be designed and built, and what is the nature of the cognitive and non-cognitive processes of young children that must be considered. At the present time, certain requirements are emerging that contrast the design of an adaptive educational environment with more traditional forms of education in the elementary school. Briefly stated, some of these appear to be the following:

1. The teaching of self-management skills and the design of educational settings in which learning-to-learn skills are fostered. The premise here is that children can modify an environment for their own learning requirements if they command the skills to do so. For this purpose, children can be taught how to search for useful information and how to order and organize it for learning and retention. In the selection of content for the elementary school, preference can be given to information and skills that maximize the possibilities for learning new things. The orientation and attending skills of children can be encouraged so that they learn to identify the relevant aspects of tasks and can attend to them with little distraction. With such information and skills, children can help guide the process of adaptive education.

2. The teaching of basic psychological processes. I have indicated this throughout my discussion. We have assumed for too long the stability of "basic aptitudes"; now we need to determine how these tal-

ents can be encouraged and taught. At the Olympic Games, young men and women joyfully exceed existing limits of human capability; in the intellectual sphere, this is also possible. The talents of individuals can be extended so that they can be provided with increased possibilities for education.

3. The design of flexible curricula with many points of entry, different methods of instruction, and options among instructional objectives. Extensive sequential curricula that must be used as complete systems and into which entry at different points is difficult will give way to more "modular" organizations of instructional units. This does not imply the abandonment of sequence requirements inherent in the structure of the material to be learned, but does imply that prerequisites, where essential, are to be specified in terms of capabilities of the learner rather than in terms of previous instructional experiences. A flexible curriculum avoids the necessity for all individuals to proceed through all steps in a curriculum sequence, and adapts to the fact that some individuals acquire prerequisites on their own, while others need more formal support to establish the prerequisites for more advanced learning. In such a system, it should be easy to incorporate new and varied instructional materials and objectives as they are developed in response to the changing educational interests and requirements of both teachers and students (Resnick, 1972).

4. Increased emphasis on open testing and behaviorally indexed assessment. In an adaptive environment, tests designed primarily to compare and select students can be expected to play a decreasing role, since access to particular educational activities will be based on a student's background together with his command of prerequisite competencies. Tests will be designed to provide information directly to the learner and the teacher to guide further learning. These tests will have an intrinsic character of openness in that they will serve as a display of the competencies to be acquired, and the results will be open to the student who can use this knowledge of his performance as a yardstick of his developing ability. These tests also will assess more than the narrow band of traditional academic outcomes. Measures of process and style, of cognitive and non-cognitive development, and of performance in more natural settings than exist in the traditional school will be required. Fortunately, this trend in process-oriented, broad-band assessment is now discernible in many new efforts.

In conclusion, it should be said that the nature of a society determines the nature of the educational system that it fosters, and educational systems tend to feed into the existing social practices. If this is so, then an adaptive educational system carried to its ultimate conclusion may be out of joint with the present social structure. An adaptive environment assumes many ways of succeeding and many goals available from which to choose. It assumes further that no particular way of succeeding is greatly valued over the other. In our current selective environment, it is quite clear that the way of succeeding that is most valued is within the relatively fixed system provided. Success in society is defined primarily in terms of the attainment of occupations directly related to the products of this system. School-related occupations are the most valued, the most rewarding, and seen as the most desirable. However, if an adaptive mode becomes prevalent and wider constellations of human abilities are emphasized, then success will have to be differently defined; and many more alternative ways of succeeding will have to be appropriately rewarded than is presently the case.

Finally, basic analysis of what I have called the "new aptitudes" and the design of adaptive environments for learning is the work that is before us. The kinds of educational systems that we can consider most desirable will be drawn only from the fullest possible understanding of human behavior and from sustained, carefully studied educational innovations with the flexibility for successive incremental improvement. The traditional formulations of the nature of individual differences in learning and the traditional modes of education fail to provide enough freedom for the exercise of individual talents. We admire individual performance, but we must do more than merely stand in admiration; we must design the effective conditions under which individuals are provided with the opportunities and rewards to perform at their best and in their way.

Notes

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Field-Dependent and Field-Independent Cognitive Styles and Their Educational Implications

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The concepts and methods derived from work on cognitive styles over the past two-and-a-half decades are being applied at an ever increasing rate to research on problems of education. Among the cognitive styles identified to date, the field-dependence-independence dimension has been the most extensively studied and has had the widest application to educational problems (Witkin, Dyk, Faterson, Goodenough, & Karp, 1962/1974; Witkin, Lewis, Hertzman, Machover, Meissner, & Wapner, 1954/1972; Witkin, 1976).[1] While research on educational applications is still in its early stages, the evidence that research has already produced suggests that a cognitive-style approach may be applied with profit to a variety of educational issues. It accordingly seems timely to bring to the attention of educators the concept of cognitive styles in general and the work on field-dependence-independence in particular, which at the mo-

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[1] Comprehensive bibliographies of research on this dimension have recently been provided by Witkin, Oltman, Cox, Ehrlichman, Hamm, and Ringler (Note 1) and by Witkin, Cox, Friedman, Hrishikesan, and Siegel (Note 2).

ment appears to have the clearest implications for educational issues.

The first part of this paper describes the field-dependence-independence dimension in some depth and deals, more generally, with the question of what cognitive styles are. The second part examines four areas in which sufficient research evidence has accumulated from application of the field-dependence-independence concept to identify the potential benefits of a cognitive-style approach for problems of education. These areas are: how students learn; how teachers teach; how teachers and students interact; how students make their educational-vocational choices and perform in the areas of their choice.

The Field-Dependent and Field-Independent Styles

To explain the nature of field-dependence-independence, we describe how work on the dimension evolved. An historical approach has been chosen to emphasize the important point that research on this style, as on most cognitive styles, had its origins in the laboratory and that the concepts and the methods of assessment now in vogue reflect that beginning.

Our earliest work was concerned with how people locate the upright in space (for example, Witkin, 1949, 1950, 1952; Witkin & Asch, 1948). We know which way is up, first of all, on the basis of information we receive from the visual environment around us. A room, for example, is filled with many verticals which correspond to the true upright in space. In addition, we make reference to sensations from within the body, as the body continuously adjusts itself to the downward pull of gravity in maintaining upright posture and balance. Ordinarily, the standard derived from the visual field and the standard derived from the body coincide in direction, and complement each other to give us an accurate sense of the location of the true upright. In our early experiments we eliminated the complex visual world in which we live and substituted for it a simpler, more manipulable visual framework; at the same time we separated the visual and bodily standards.

Figure 1 shows one of several situations we developed, following that strategy. In this situation the substitute visual framework is a luminous square frame presented to the subject in a completely darkened room. The frame can be rotated about its center clockwise or counterclockwise. Pivoted at the same center is a luminous rod which can also be tilted clockwise or counterclockwise, independently of the frame. Frame and rod, presented in tilted positions, are all the subject can see in the darkroom (although more is shown in Figure 1 because of the

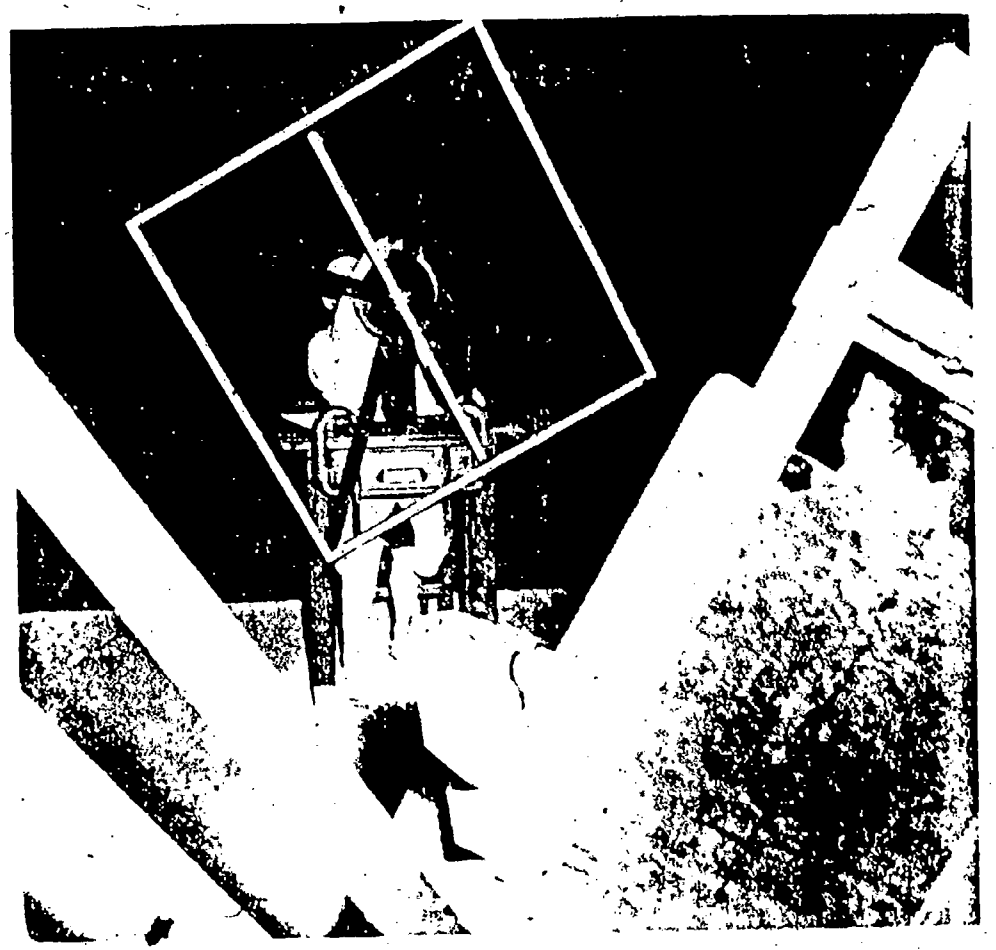

Figure 1. Rod-and-frame test

light needed to take the photograph). The subject's task is to adjust the rod to a position where he perceives it as upright, while the frame around it remains in its initial position of tilt.

Important for the issue of styles was the early finding of marked individual differences among people in how they perform this task. For some, in order for the rod to be apprehended as properly upright, it must be fully aligned with the surrounding frame, whatever the position of the frame. If the frame is tilted 30° to the right, for example, they will tilt the rod 30° to the right, and say the rod is perfectly straight in that position. At the opposite extreme of the continuous performance range are people who adjust the rod more or less close to the upright in making it straight, regardless of the position of the surrounding frame. They evidently apprehend the rod as an entity discrete from the prevailing visual frame of reference and determine the

uprightness of the rod according to the felt position of the body rather than according to the visual frame immediately surrounding it.

Another situation we developed to determine the roles of the visual and bodily standards in perception of the upright is shown in Figure 2. Here, the object of perception is the body, rather than an external object, such as a rod, and the issue is how people determine the position of the body itself in space. The subject is seated in the chair, which can be tilted clockwise or counterclockwise; the chair is projected into the small room which can also be tilted clockwise or counterclockwise, independently of the room. After the subject is seated, the chair and room are brought to prepared tilted settings, and the subject is then asked to adjust the chair to a position where he experiences it as upright. From this account it is not difficult to see that the body-

Figure 2. Body-adjustment test

adjustment situation and the rod-and-frame situation are in fact structurally similar. In each there is an item—rod or body—surrounded by a visual field—frame or room—and the question is to what extent perception of the item is determined by the surrounding framework.

Individual differences in performance in the body-adjustment situation are very similar to those described for the rod-and-frame situation. There are some people who perceive their own bodies as upright when they are fully aligned with the surrounding tilted room. It may be astounding that someone can be tilted as much as 35 degrees, and, if in that position he is aligned with the room, tilted at the same angle, he will report that he is perfectly straight, that "this is the way I sit when I eat my dinner," "this is the way I sit in class." At the other extreme of the performance range we find people who, regardless of the position of the surrounding room, bring the body more or less to the upright. They seem able to apprehend the body as an entity discrete from the surrounding field, which, in people at the other extreme, exerts a profound effect on their perception of body position. Here again most people fall between the two extremes just described.

We may interpolate here that everyone is very accurate when the same task of straightening the body is conducted with eyes closed. The individual differences we have been considering are thus clearly the consequence of the conflict created between the standard of uprightness derived from the surrounding field and the standard derived from within the body.

The early work on field-dependence-independence made use of a third situation, shown in Figure 3. Although it does not involve perception of the upright or the body, it is actually quite similar to the rod-and-frame and body-adjustment situations in its essential perceptual structure. In this embedded-figures situation,

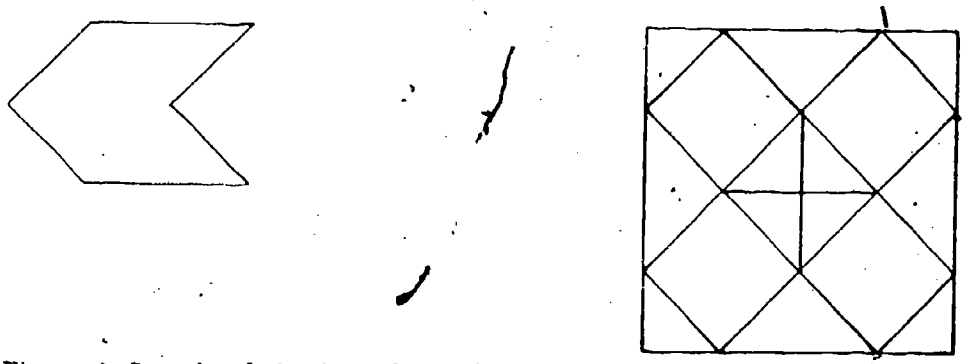

Figure 3. Sample of simple and complex figures similar to those used in the Embedded-Figures Test.

the subject is shown the simple figure on the left; it is then removed and he is shown the complex figure on the right, with the directive to locate the simple figure within it. What has been done in composing the complex figure is to "use up" the lines of the simple figure in various subwholes of the complex figure, so that perceptually, the simple figure no longer appears to be there. Describing the situation in these terms makes evident its similarity to the two space-orientation situations. Here, too, the subject is presented with an item—now a simple geometric design rather than a rod or the body—which is contained within a complex organized field—now a complex design rather than a frame or room—and, once more, what is at issue is the extent to which the surrounding visual framework dominates perception of the item within it. Again, individual differences in performance are very marked, and they are similar in nature to those described for the first two tasks. For people at one extreme the sought-after simple figure quickly emerges from the complex design, whereas people at the other extreme are not able to identify the simple figure in the time allowed for search.

In all three situations considered we come out with a quantitative indicator of the extent to which the surrounding organized field has influenced the person's perception of an item within it. In the first two situations the subject's score is the amount of tilt of rod or body, in degrees, when these items are reported to be straight. In the embedded-figures situation the score is the time taken to locate the simple figure in the complex design.

Now of importance for the issue of cognitive styles is the evidence of self-consistency in performance across tasks. If the same person is tested in the situations we have been examining, it is found that the person who tilts the rod far toward the tilted frame in making it straight is likely to be the person who tilts his body far toward the tilted room to perceive the body as upright, and he is also likely to be the person who takes a long time to find the simple figure in the complex design. This kind of self-consistency has been found to extend across tasks involving sense modalities other than those featured in the three tasks we have examined—including, for example, an auditory embedded-figures task, where a simple tune must be located in a complex melody, and a tactile embedded-figures task, where, with eyes closed, a felt-out simple figure, composed of raised contours, must be identified in a complex figure, similarly composed of raised contours (Axelrod & Cohen, 1961; White, 1954; Witkin, Birnbaum, Lomonaco, Lehr, & Herman, 1968).

As must be evident from the descriptions given, the common denominator underlying individual differences in performance in these various tasks is the extent to which the person perceives

part of a field as discrete from the surrounding field as a whole, rather than embedded in the field; or the extent to which the organization of the prevailing field determines perception of its components; or, to put it in everyday terminology, the extent to which the person perceives analytically.[2] Because at one extreme of the performance range perception is strongly dominated by the prevailing field, that mode of perception was designated "field dependent." At the other extreme, where the person experiences items as more or less separate from the surrounding field, the designation "field independent" was used. Because scores from any test of field-dependence-independence form a continuous distribution, these labels reflect a tendency, in varying degrees of strength, toward one mode of perception or the other. There is no implication that there exist two distinct types of human beings.

People are likely to be quite stable in their preferred mode of perceiving, even over many years (for example, Bauman, 1951; Faterson & Witkin, 1970; Witkin, Goodenough, & Karp, 1967). Furthermore, in Western societies there are small but persistent sex differences in field-dependence-independence, beginning in adolescence. Women, on the average, tend to be more field dependent than men. It should be stressed, however, that the difference in means between the sexes is quite small compared to the range of scores within each sex; in other words, the distributions for the two sexes show considerable overlap. Evidence from recent cross-cultural studies that sex differences in field-dependence-independence may be uncommon in mobile, hunting societies and prevalent in sedentary, agricultural societies—societies which are characteristically different in sex-role training and in the value attached to women's roles in the economy—points up the important role of socialization in the development of sex differences in field-dependence-independence (Witkin & Berry, 1975; Stewart, Note 3).

In place of the rather complex gadgets required for some of the early laboratory tests of field-dependence-independence there are now available simpler devices and even group tests; and there are tests which, among them, are applicable to the entire age span, from the preschool period onward. For example, there has been developed a small table-top model of the rod-and-frame apparatus, which can easily be transported to where there are

[2] Several studies have shown that the presence of an organized field, which must be "broken up" in order to identify the sought-after item, is an essential feature of tasks which tap this dimension. Thus, tasks of this kind have been found to load a different factor than tasks in which the field from which the item must be extracted has no inherent organization and so serves merely as a distraction to the subject in his search for the item (for example, Karp, 1963; Sack & Rice, 1974).

subjects to be tested and which makes a darkroom unnecessary (Oltman, 1968). There are also now available preschool (for ages 3-5) and children's (for ages 5-9) forms of the embedded-figures test, as well as a group form of the embedded-figures test for adults (see Coates, 1972; Witkin, Oltman, Raskin, & Karp, 1971). These tests have been shown to have good reliability.

Thus far we have been examining the ways in which people deal with an immediately present stimulus configuration, in other words, how they perceive. Extensive evidence, accumulated over the years, shows that the styles we first identified in perception manifest themselves as well when the person is dealing with symbolic representations, as in thinking and problem solving. The individual, who, in perception, cannot keep an item separate from the surrounding field—in other words, who is relatively field dependent—is likely to have difficulty with that class of problems, and, we must emphasize, *only* with that class of problems, where the solution depends on taking some critical element out of the context in which it is presented and restructuring the problem material so that the item is now used in a different context.

An example of such a situation is provided by an unpublished study of Frances Harris (Note 4), who used two of the problem-solving tasks employed by Duncker (1945) in his classical studies of functional fixity. To illustrate, in one of these the subject is required to construct a stand (or shelf) consisting of a board resting on two supports. The experimenter, in fact, makes available the items required for such a structure; in the experimental room there are, among other objects, a board, one support, and a pair of pliers. The support is nailed to the board by the experimenter in such a way that if the subject is to use the support as part of the stand he must first remove the nail. To carry out this task the subject has to use the pliers in its conventional function. However, to construct the shelf the pliers also has to be used as the second support for the shelf. Obviously, for the pliers to be used as a support, it must be "taken out of " its conventional functional context and conceived of in its less commonplace context of serving as a support. Here, as in the perceptual tasks we considered earlier, what is at issue is the degree of adherence to a predominant context. Harris found that, to a striking degree, people who were field independent in laboratory tests of perception more easily overcame the predominant context in the pliers problem.

It is clear from this and other evidence that the individual-differences dimension first picked up in perception shows itself equally in the problem-solving domain.

A next research step further enlarged the scope of the dimension. As we have seen, a relatively field-independent person is likely to overcome the organization of the field, or to restructure it, when presented with a field having a dominant organization, whereas the relatively field-dependent person tends to adhere to the organization of the field as given. This characteristic difference in manner of approaching the field also showed itself under circumstances where the field lacks inherent organization—for example, Rorschach inkblots. In the great preponderance of studies performed on this issue relatively field-independent persons have been found more likely to impose structure spontaneously on stimulus material which lacks it, whereas relatively field-dependent persons were here again likely to leave the material "as is" (for example, Moore, Gleser, & Warm, 1970; Nebelkopf & Dreyer, 1970; Witkin et al., 1962/1974).

It is noteworthy that this difference in propensity toward imposing structure when it is lacking is not limited to straightforwardly perceptual material, such as Rorschach inkblots or ambiguous stimuli. It has been found in studies with verbal materials as well (Bruce, 1965; Kleine, 1967; Stasz, 1974). In the study by Stasz (1974), for example, structuring of curricular content by field-dependent and field-independent high school teachers and their students was examined in a social-studies minicourse. Some content areas, such as mathematics and natural science, have a content structure in which many concepts are functionally related to each other (Johnson, 1969; Shavelson, 1974). However, in the area of social studies such a content structure is less clear, leaving the organization of concepts to the individual. In the Stasz study psychological structuring was inferred from subjects' ratings of similarity among 10 general anthropological concepts, such as "culture," "society," and "civilization." Both before and after minicourse instruction field-dependent teachers and students made fewer distinctions among concepts. For field-dependent teachers and students, concepts clustered into a large, loosely organized group which included most of the concepts. For field-independent teachers and students, concepts clustered into small, tight groups with less overlap across groups.[3]

The evidence linking structuring tendencies to analytical tendencies (of the kind involved in field-dependence-independence) suggested that the individual differences with which we were dealing might best be conceived as an articulated-global continuum. Analyses and structuring are complementary aspects of

[3] In a later section, "How children learn," we will examine studies which consider the consequences for learning of this difference between relatively field-dependent and field-independent children in tendency to structure, or, as we shall designate it there, in the tendency to use organizational mediators.

articulation. The person who experiences in an articulated fashion tends to perceive items as discrete from background, when the field is organized, and to impose structure on a field, and so perceive it as organized, when the field has relatively little inherent structure. In contrast, it may be said that experience is more global when it accords with the overall character of the prevailing field as given, and involves less intervention of mediators, such as analysis and structuring. The articulated-global concept is applicable to the processing of information both from an immediately present stimulus configuration, as in perception, or from symbolic material, as in intellectual functioning.

From such evidence it became clear that we were dealing with a broad dimension of individual differences that extends across both perceptual and intellectual activities. Because what is at issue is the characteristic approach the person brings with him to a wide range of situations—we called it his "style"—and because the approach encompasses both his perceptual and intellectual activities—we spoke of it as his "cognitive" style.

The picture of self-consistency thus far described was subsequently extended by the demonstration that the individual modes of functioning earlier identified as cutting across the perceptual and intellectual domains extend into other domains, traditionally subsumed under "personality."

Particularly impressive is the evidence of differences in characteristics falling in the domain of social behavior between people with a relatively articulated or relatively global cognitive style. Taken collectively, the social characteristics that distinguish persons with contrasting styles suggest that relatively field-dependent persons, in contrast to more field-independent ones, are likely to be attentive to and make use of prevailing social frames of reference, just as in the perceptual situations we considered earlier they were found to rely on the prevailing perceptual frame of reference (Witkin & Goodenough, in press).

On the side of attentiveness to social cues, impressive evidence from many studies, using a variety of approaches and procedures, indicates that field-dependent persons have what in effect amounts to a sensitive radar system, selectively attuned to social components of the environment. This tendency shows itself in many social modalities. Thus, it has been demonstrated that relatively field-dependent persons, more than field-independent ones, literally look more at the faces of others, the primary source of information about what others are feeling and thinking (for example, Konstadt & Forman, 1965; Nevill, 1972; Ruble & Nakamura, 1972). The selective interest of relatively field-dependent persons in social aspects of the surround is not limited to faces. There are studies which suggest (although the evidence

is not entirely consistent) that they attend more to verbal messages with social content, even when these messages occur in the periphery of attention (for example, Eagle, Fitzgibbons, & Goldberger, 1966; Eagle, Goldberger, & Breitman, 1969; Fitzgibbons & Goldberger, 1971; Fitzgibbons, Goldberger, & Eagle, 1965).

Another way in which relatively field-dependent persons show their "social orientation" is in taking greater account of external social referents in defining their attitudes and feelings (for example, Linton, 1952; McFall & Schenkein, 1970; Rudin & Stagner, 1958; Solar, Davenport, & Bruehl, 1969), particularly under conditions of ambiguity. It seems not implausible that their use of such referents is facilitated by the information they acquire through their greater attentiveness to social cues, as just described. Linton's study with an autokinetic situation provides a particularly good example of the responsiveness of field-dependent persons to external social referents. In the autokinetic situation a stationary pinpoint of light, viewed in a completely darkened room, is ordinarily seen as moving. The college undergraduates who served as subjects were asked to write down their judgments of the amount of light movement on each of a series of trials. The procedure was then repeated, but now subjects made their judgments on each trial after learning the judgment of a planted confederate who, by prearrangement, gave estimates substantially higher than the average of the subjects' initial judgments. To endow him potentially with some degree of prestige, the confederate was introduced as a senior psychology major. As predicted, field-dependent subjects showed significantly larger increases in their estimates under the influence of the confederate's judgments than field-independent subjects. This accommodation appears quite reasonable when we consider that because judgments in the autokinetic situation are made in total darkness, there is no frame of reference for estimating movement. Under these conditions of ambiguity, the estimates given by the confederate, whom the subjects had no reason to mistrust, provided additional information which field-dependent subjects, who are less likely to structure situations on their own, could use in making their judgments.

It is now also well documented that, in addition to being sensitive to social cues, and interested in what others say and do, relatively field-dependent persons are drawn to people, in the sense of liking to be with them. This "with-people" stance is even evident in such directly discernible ways as their use of interpersonal space. Several studies have demonstrated that field-dependent persons literally prefer to be physically close to others. In one of these studies, subjects were required to prepare a brief presentation on a topic assigned to them and then to

proceed to another room and make the presentation orally to the experimenter seated there (Justice, 1970). In another study, subjects were asked actually to assume the positions they considered optimal, maximal or minimal for comfortable communication with another person (Holley, 1972). In both studies, field-dependent subjects, relative to field-independent ones, took up positions significantly closer to the person with whom they were interacting. Trego (1972), who also determined how close to an "object person" his subjects moved, with variations in the initial distance between subject and object person, obtained results consistent with those of Holley and Justice. In still another study the nonverbal behavior of obese patients was examined, when seated two feet or five feet from the interviewer (Greene, 1973). At the greater distance compared to the shorter one, field-dependent persons showed a significant increase in a cluster of nonverbal behaviors (such as palms-up gesture, mouth touching, foward leaning) which loaded a "dependency" factor, interpreted as expressive of need for closeness to others. Field-independent persons were unaffected by the distance manipulation. On the other hand, at both distances, field-independent persons, as compared to field-dependent persons, showed significantly more nonverbal behaviors (such as arm crossing, leg crossing, absence of forward leaning), loading a "distancing" factor interpreted as reflecting a need to gain psychological distance from others. In three other studies, no relation was found between field-dependence-independence and social-distance preference (Evans, 1970; Wineman, 1974; Guardo, Note 5). It is noteworthy, however, that these studies used a questionnaire format or representations of human figures (such as silhouettes or cut-outs) to assess use of interpersonal space, rather than real people, as in the four studies cited above.

The ingredients of the social orientation of field-dependent persons that have been enumerated make it not surprising that they should be better liked (for example, Dingman, 1972; Oltman, Goodenough, Witkin, Freedman, & Friedman, 1975); perceived as warm, tactful, considerate, socially outgoing, and affectionate by others (Crutchfield, Woodworth, & Albrecht, 1958; Pemberton, 1952; Weissenberg & Gruenfeld, 1966); know and be known to more people (Oltman et al., 1975). These social qualities, taken together, seem likely to contribute to greater skill in getting along with people.

In contrast to the "with-people" orientation of field-dependent persons, field-independent persons tend to have a more impersonal orientation. For example, Pemberton (1952) found that field-independent subjects, in their responses to a personality inventory she developed, showed themselves to be "not sensitive

to social undercurrents" and in reports by Crutchfield et al. (1958) and Crutchfield and Starkweather (Note 6) field-independent subjects were described as "cold and distant with others," "unaware of their social stimulus value" and "individualistic." There is additional evidence that, joined with their impersonal orientation, field-independent people are more likely to be interested in the abstract and theoretical (for example, Biggs, Fitzgerald, & Atkinson, 1971; Heath, 1964; Jay, 1950; Pemberton, 1952; Stidham, 1967).

A further indicator of the contrasting social and impersonal orientations of field-dependent and field-independent people—one which has obvious implications for career differentiation—is found in the tendency of field-dependent students, on the one hand, to favor educational-vocational areas in which involvement with others is a central feature and in which the subject matter of the discipline features human content, and the tendency of field-independent students, on the other hand, to favor areas that are more solitary in their work requirements and more abstract in their substantive content. We return to this issue in a later section where we consider educational-vocational interests and choices as a function of cognitive style.

The preceding discussion has been concerned with the area of experience where the person's own attributes and activities are the primary source (that is, the self), rather than stimuli in the field "out there," as in the case of perceiving. What has been said in that discussion suggests that field-independent persons are more likely to be aware of needs, feelings, attributes, which they experience as their own and as distinct from those of others. These distinctive needs, feelings, and attributes in effect provide internal frames of reference to which the person may adhere in dealing with external social referents. In the separateness of self from nonself, such people may be said to have a self which is experienced as segregated; and, with the availability to them of distinctive internalized frames of reference, they may be said to have a self which is experienced as structured. These are essentially the characteristics we earlier subsumed under "articulated." In contrast, the characteristics of relatively field-dependent persons of having less distinctive and less closely adhered to internal frames of reference, and of showing greater continuity between self and nonself—in other words, less segregation and less internal structure—are indicative of a more globally experienced self. We have spoken elsewhere of this difference in ways of experiencing the self as a difference in extent of "sense of separate identity" (Witkin et al., 1962-1974).

The difference in sense of separate identity between relatively field-dependent and field-independent people has consequences

for the nature of the social roles they are likely to assume in particular circumstances. In general, for field-dependent people, compared to field-independent ones, social roles tend not to be defined as distinct from the roles of those with whom they interact. Evidence of this is provided by several studies of therapist roles. One study showed that field-independent therapists were likely to adopt noninvolving or directive approaches to treatment, whereas relatively field-dependent therapists tended to favor approaches which were less directive and likely to involve them in interaction with their patients (Pollack & Kiev, 1963). Another study (Witkin, Lewis, & Weil, 1968) revealed a tendency for field-dependent therapists to share "speaking time" more equally with their patients than did field-independent therapists. We will see later, in the section, "How teachers teach," that there are similar differences in teachers' classroom behavior, as a function of differences in cognitive style.

We can do no more than mention here that the articulated-global dimension has been shown to extend beyond the domains through which we have thus far traced it, into the domains of body concept and defenses. In the body-concept domain it has been demonstrated that relatively field-independent persons are likely to have an articulated conception of the body, that is, to experience the body as having definite limits or boundaries and the parts within as discrete yet interrelated and formed into a structured whole; relatively field-dependent persons tend to have a more global conception of the body (Adevai, Silverman, & McGough, 1968; Faterson & Witkin, 1970; Goldberger & Bendich, 1972; Witkin et al., 1962/1974). In the defenses domain, more field-independent persons are likely to use specialized defenses, such as intellectualization; relatively field-dependent persons tend to favor nonspecific defenses, such as repression (Schimek, 1968; Witkin et al., 1962/1974).

We thus come out of this account of the unfolding of the work with the conclusion that there is a broad dimension of self-consistency in forms of cognitive functioning—the articulated-global dimension—which runs through the perceptual and intellectual domains, as well as domains commonly conceived of as "personality"—social behavior, body concept, and defenses.[4]

Using this detailed characterization of the articulated and global cognitive styles, we may now enumerate the essential characteristics of cognitive styles in general.

[4] Elsewhere we have proposed that "differentiation" provides a developmental framework for viewing the self-consistencies that have been described here (Witkin et al., 1962/1974).

First, cognitive styles are concerned with the form rather than the content of cognitive activity. They refer to individual differences in *how* we perceive, think, solve problems, learn, relate to others, etc. The definition of cognitive styles is thus cast in process terms. This feature is a natural consequence of the origin of cognitive-style dimensions in laboratory studies, where process is the central issue. The experimental literature on the processes underlying field-dependent and field-independent behavior is now quite extensive (Witkin et al., 1962/1974; Witkin et al., Note 1; Witkin et al., Note 2). As we make progress toward more precise specification of these processes, suggestions are emerging, as we shall see, for ways of teaching students to use problem-solving strategies most appropriate to their styles, and even to shift to strategies more suitable for the task at hand than their preferred strategies.

Second, cognitive styles are pervasive dimensions. They cut across the boundaries traditionally—and, we believe, inappropriately—used in compartmentalizing the human psyche and so help restore the psyche to its proper status as a holistic entity. This characteristic has important implications for the educational setting. Reflecting their pervasiveness, cognitive styles carry a message about what we traditionally call "personality." So, it is a feature of personality, and not alone of cognition in the narrow sense, that an individual likes to be among people, is particularly attentive to what others say and do, and takes account of information from others in defining his own beliefs and sentiments. It is something of a paradox—but on the surface only—that tests of cognitive style have potential value in assessing what have come to be called "noncognitive" attributes. The pervasiveness of cognitive styles also means that they can be assessed by nonverbal (perceptual) methods. This is a feature which also stems from the origin of cognitive-style work in the laboratory. To the extent that perception can be assessed by objective, controlled techniques, perceptual performance may be used as a measurable "tracer" for identifying an individual's cognitive style. The use of nonverbal perceptual techniques to assess an individual's cognitive makeup helps avoid the penalty which students out of the mainstream culture commonly suffer on our usual heavily verbal assessment procedures (Witkin, Faterson, Goodenough, & Birnbaum, 1966).

A third characteristic of cognitive styles is that they are stable over time. This does not imply that they are unchangeable; indeed, some may easily be altered. In the normal course of events, however, we can predict with some accuracy that a person who has a particular style one day will have the same style the next day, month, and perhaps even years later. This

stability makes stylistic dimensions particularly useful in long-range guidance and counseling.

Fourth, with regard to value judgments, cognitive styles are bipolar. This characteristic is of particular importance in distinguishing cognitive styles from intelligence and other ability dimensions. To have more of an ability is better than to have less of it. With cognitive styles, on the other hand, each pole has adaptive value under specified circumstances, and so may be judged positively in relation to those circumstances. This is clearly evident in the case of the articulated-global dimension, where the cluster of competence in cognitive artículation plus an impersonal orientation, at one pole, and the cluster of a social orientation and social skills plus less competence in articulation, at the other pole, may each be seen as especially suited to meet the requirements of particular tasks. When we come to discuss career differentiation, we will provide a number of illustrations of this, but one example may be cited here. In a recent study (Quinlan & Blatt, 1972), psychiatric student nurses who were judged to be good by their mentors were compared on tests of field-dependence-independence to surgical nurses who were judged to be good. Whereas the psychiatric group proved to be relatively field dependent, the surgical group was relatively field independent. This outcome is not surprising when we consider the tasks to be performed in psychiatry and surgery. Effective work in psychiatric nursing leans heavily on an interest in people and on social sensitivity, but not particularly on analytical skills. This job description fits the makeup of the relatively field-dependent individual. In contrast, surgical nursing does not call particularly on social interests and sensitivities; too often the surgical nurse's encounter with a patient is limited to a small segment of the patient's exposed abdomen! Success as a surgical nurse is likely to depend more on skill in quickly disembedding the correct forceps from a complex array of instruments on a surgical tray. This job description is in line with the makeup of the relatively field-independent individual.[5]

[5] Although the articulated-global dimension is bipolar, all the tests now commonly used in its assessment require an articulated approach for successful performance. An urgent task now to be met is the development of standardized tests that require a global approach for successful performance. There is another feature worth noting about the present psychometric state of affairs in assessment of the articulated-global dimension. Because tests of cognitive articulation, such as the standard tests of field independence, are abilities tests, and because abilities may share an underlying general competence component (G), some relation may be expected between field-independence measures and other ability measures. Positive correlations have, in fact, been reported, but not consistently, and when they do occur, they tend to be quite small. Taking as illustrative so important a human competence as verbal ability, we find that tests of this ability, such as the

As pointed out elsewhere (Witkin, 1974), the more neutral character of cognitive styles, deriving from their value bipolarity, makes it less threatening and therefore easier to communicate information about an individual's cognitive style directly to him, than it is to convey some kinds of information about his abilities, as, for example, telling him he has a low IQ. In a period when we are seeking ways of using evaluation procedures to serve the student himself, rather than the institution, this feature of cognitive styles is indeed an important advantage.

Taking as background what we have said about the articulated and global cognitive styles, and about the nature of cognitive styles in general, we turn now to the implications of work on these styles for educational issues.

Educational Implications of Cognitive Styles

How Students Learn

Studies of the role of cognitive style in student learning have used both the cognitive and social characteristics constituent in the articulated-global dimension to conceptualize relations between learning behavior and cognitive style. Of the four learning areas we consider, the first two have used the social characteristics as a bridge between the domains. These two areas are learning of social material and the effects of social reinforcement. The third and fourth learning areas used mainly the cognitive characteristics as a bridge. These are the areas of mediating mechanisms in learning and cue salience.

Learning of Social Material

We have seen that relatively field-dependent[6] people are particularly interested in and selectively attentive to social aspects of the surround. It need not be surprising to find that, because of this orientation, such persons are better at learning materials

Vocabulary, Information, and Comprehension subtests of the Wechsler scales, load a separate factor from tests of field independence (Goodenough & Karp, 1961; Karp, 1963). Furthermore, scores from the Verbal Scholastic Aptitude Test, one of the major standard tests of verbal functioning now in use in the educational setting, have been found to show an average correlation of less than .17 with field independence measures in the data from 21 studies. In addition, the results of 2 studies with adults which examined the relation between scores from tests of field-dependence-independence and scores from vocabulary tests yielded a mean correlation of only .18 between these two kinds of measures.

[6] Because the early designations, "field dependent" and "field independent" have come into popular usage, we shall employ them in the remainder of this paper, taking them to stand for "global" and "articulated."

with social content. Now relatively field-dependent and field-independent persons seem not to be appreciably different in sheer learning ability or memory. However, reflecting differences between them in what is relevant, attended to, and salient, field-dependent persons tend to be better at learning and remembering social material than persons who are relatively field independent.

Illustrative of several studies which examined the role of cognitive style in learning social material is one by Ruble and Nakamura (1972). The children who were subjects in the study were given three concept-attainment problems; on each trial of each problem their task was to identify the correct figure among three shown to them. In the first problem, "large size" was correct, but the experimenter provided an additional redundant cue, social in nature, by looking at the figure which was correct. In the second problem, the social cue alone was relevant; and in the third problem, size alone was the correct cue. The field-dependent children showed better learning than field-independent children on the second problem, which featured the social cue alone. On the other hand, the field-independent children showed better learning on the third problem, which did not involve social cues at all. This pattern of findings makes it evident that field-dependent children were better at picking up social cues provided by the adult experimenter, and using these cues in learning.

Another example of field-dependent persons' superior memory for social information comes from a study by Crutchfield et al. (1958). These investigators found that relatively field-dependent army officers did significantly better than field-independent officers in recognizing photographs of other officers who had spent several days with them at an assessment center. The clear finding from a number of studies (for example, Adcock & Webberley, 1971; Baker, 1967) that field-dependent persons are not superior in recognizing faces when the task is one of intentional learning of faces suggests that their superiority in the Crutchfield et al. study was a function of selective attention to the faces of their peers rather than of better ability to learn and remember such material.

Relevant here too are studies which have shown that field-dependent persons are better at learning social material, when the material is peripheral to the task on which they are concentrating. For example, Fitzgibbons et al. (1965) used an incidental-learning paradigm in which the subject was given a learning task to perform while in another part of the room, separated by a curtain so that sounds could get through, a "planted" subject, in another "experiment," called out words.

Among these words were some that had social connotations and others that were neutral. At the end of the experiment the "real" subject was unexpectly asked to recall any words he had heard from the other side of the curtain. The relatively field-dependent subjects recalled more social words than the field-independent subjects, but for the neutral words there was no difference.[7]

The findings that have been reviewed suggest that field-dependent persons are better at remembering social material and that this superiority is based on their selective attention to social material.

The implications of these findings for the classroom are apparent. Because of their social orientation relatively field-dependent children are apt to be particularly adept at learning and remembering materials that have social content. To the extent that the inferiority of field-independent children with such material is a function of lack of attention, rather than lack of ability, their performance can easily be made equivalent to that of field-dependent children by bringing social material to focal attention, as was done in studies which made the learning of such material an intentional task.

The Effects of Reinforcement

A second way in which students' cognitive styles may influence their learning is found in the effects of different kinds of reinforcement. The relations that have been observed between cognitive style and reinforcement may be understood on the basis of differences in sense of separate identity between relatively field-dependent and field-independent persons. As described earlier, individuals with an articulated cognitive style are likely to have internalized frames of reference to which they adhere as guides to self-definition and which they maintain as distinctly separate from external social referents. Those with a global style tend to rely more on external referents for self-definition. On this basis we may expect that field-dependent students would be more likely to require externally defined goals and reinforcements than field-independent students who tend to have self-defined goals and reinforcements.

[7] Other studies have demonstrated a similar superiority of field-dependent persons in incidental learning of social cues (for example, Eagle et al., 1960; Messick & Damarin, 1964), although there have been studies in which this superiority was not evident (for example, Beijk-Docter & Elshout, 1969; Fitz, 1971). In contrast to this picture for incidental learning of social material, the results of numerous studies of incidental learning of nonsocial material show a small but general superiority of field-independent subjects in such learning tasks (for example, Beck, 1971; Iman, 1973; Klein, 1968; Valinsky, 1971; Witkin et al., 1962/1974).

A great deal of evidence is now available, from experimental situations, on the relation between field-dependence-independence and the effects of various kinds of reinforcement. The evidence suggests, as expected, that field-independent persons tend to learn more than field-dependent persons under conditions of intrinsic motivation (for example, Fitz, 1971; Paclisanu, 1970; Steinfeld, 1973). However, this difference disappears when external rewards for learning are introduced, regardless of whether the rewards are material in nature or in the form of praise (for example, Ferrell, 1971; Paclisanu, 1970; Steinfeld, 1973).

The study by Steinfeld may be used to illustrate these findings. Eight- and 11-year-old children played an experimental game called "marble in the hole." There were two holes into which the child could drop marbles. After a baseline period in which the child's preference for one hole or the other was observed, the nonpreferred hole was reinforced, and the effect of the reinforcement of the percentage of marbles dropped into this hole was determined. The effects of three types of reinforcements were then compared. In one type of reinforcement (abstract) a flashing light came on when the child dropped marbles into the initially nonpreferred hole. In this condition light served as a cue for self-reward, and, as expected, field-independent children learned more than field-dependent children. A second type of reinforcement (material) made use of token rewards which were redeemable for small toys. With such material rewards field-dependent children did as well as field-independent children. A similar result was obtained with a third type of reinforcement (social) which took the form of praise from the experimenter. Thus, with intrinsic motivation, field-independent children did better, but this difference was eliminated when extrinsic rewards—material or social—were used.

Most of the research on the effects of punishment have made use of social reinforcement given in the form of verbal criticism. These studies provide evidence that field-dependent people are more affected by criticism than field-independent people. Whether the criticism has a positive or adverse effect on learning depends upon the manner in which the criticism is administered. Either way, this type of external reinforcement seems to have a particularly potent effect on field-dependent persons (for example, Duvall, 1970; Ferrell, 1971; Fitz, 1971; Konstadt & Forman, 1965; Randolph, 1971).

Whether used consciously or unconsciously, reinforcement is one of the handiest tools in the teachers' armamentarium of devices for perpetuating some student behaviors and eliminating others. Common sense and everyday experience in the classrooms make it not at all surprising that reinforcement does not work equally well for all students or that particular kinds of reinforcement have differential effects on different kinds of students. While applied research in the classroom has only just begun (Raab, 1974), the evidence we have reviewed suggests that field-dependence-independence may provide a useful basis for predicting which students are likely to be affected by what kinds of reinforcement.

The Use of Mediators in Learning

In the cognitive realm, as we have seen, persons with an articulated cognitive style are likely to analyze a field when the field is organized, and to impose structure on a field when the field lacks organization of its own. Persons with a global style are more likely to go along with the field "as is," without using such mediational processes as analyzing and structuring. In many situations field-independent people tend to behave as if governed by general principles which they have actively abstracted from their experiences. Depending on the situation they find themselves in, these abstractions may be correct or incorrect, useful or useless, but the performance of people to whom they are available may be understood in terms of the operation of such mediating concepts. In contrast, for field-dependent people information-processing systems seem to make less use of such mediators.

The principle that field-independent people more often make use of mediators is illustrated by studies of organizational factors in learning. Frequently in learning, the material to be learned lacks clear inherent structure, creating the requirement that the learner himself provide organization as an aid to learning. Field-dependent persons are likely to have greater difficulty in learning such material compared to field-independent persons who are more likely themselves to provide the mediating structural rules that are needed to facilitate learning. On the other hand, when the material to be learned is presented in an already organized form, so that structuring is not particularly called for, field-dependent and field-independent people are not likely to differ in their learning. Several studies may be cited to illustrate these points.

In one study (Fleming, 1968), a list of words was shown to field-dependent and field-independent subjects and free recall of the words subsequently measured. A novel feature of the study was that the words belonged to a hierarchical structure and were presented to the subjects in either a superordinate to subordinate sequence (e.g., animal, vertebrate, man) or vice versa (e.g.,

man, vertebrate, animal). When the superordinate items came first, the word set was given an inherent organization from the beginning. This advance organizational aid to learning was missing, however, in the subordinate to superordinate sequence. It might be expected, therefore, that the subordinate to superordinate sequence would be particularly difficult for field-dependent people. This proved to be true. Fleming's field-dependent subjects recalled fewer words than his field-independent subjects when this sequence was used. In contrast, no significant relationship was found between field-dependence-independence and word recall with the structured, superordinate to subordinate sequence.

In a second study, Koran, Snow, and McDonald (1971) examined the acquisition of a teaching skill from written and video-modeling procedures. These two treatments were found to be differentially effective for relatively field-dependent and field-independent intern teachers. Field-dependent teachers were found to benefit more from the video modeling than field-independent teachers who did as well with the written as with the video modeling. The authors suggest that for the more field-dependent teachers

> The video-modeling treatment . . . through explicit, concrete presentation of the stimulus elements . . . may provide a behavioral representation for the learner that he could not generate for himself if given the written-modeling treatment. (p. 226)

Two studies which used programmed instruction sequences varying in the amount of structure provided by the programmed text are also relevant here. In the first study (Schwen, 1970), the number of generalizations and examples given before an active response was required by the learner was varied. In one (large-step) version of the text, all of the generalizations of an "imaginary" science were presented first with examples and discussion, and then the learner was asked to answer questions and to solve some problems, with corrective review if he responded incorrectly. In the second (small-step) version, each generalization was presented individually with examples and discussion, and the learner answered questions with corrective review after each section before proceeding to the next one. In this way, the second version broke the learning sequence down so that each learning block covered one generalization at a time, while the first version left the learner to monitor his own learning of the material before the final test. In the small-step program condition, there was no relation between field-dependence-independence and retention three weeks later. However, in the large-step program

conditions, greater field independence was associated with greater retention.

In the second programmed instruction study (Renzi, 1974), the amount of feedback given the learner was varied. Each subject was required to learn to draw an "exact" ellipse. In one version of the text, subjects were not given feedback about their performance when they attempted to draw the ellipses required by the text. In the second version, a correctly drawn ellipse was provided as an overlay in the text. Results indicated that the performance of relatively field-independent university students was not influenced by whether or not they received feedback in the text. On the other hand, field-dependent students performed significantly better on the posttest when feedback was provided in the text.

Consistent with these findings on field-dependent people's greater need for external structuring were the teachers' reports on students of different cognitive styles made after a minicourse organized by us for a study (unpublished) of the role of teachers' and students' cognitive styles in the teaching-learning process, to be described later. In an analysis of teachers' responses to a questionnaire he constructed for this study, our colleague, Walter Emmerich, found that teachers described field-dependent students as profiting more from "providing students with a plan"; field-independent students were described as profiting less from such a teaching approach.

Evidence from another quite different naturalistic situation—psychotherapy—suggests that the greater need of field-dependent persons for externally provided structure is a general characteristic of their behavior. Greene (1972) found that therapists significantly more often chose supportive therapy for their field-dependent patients and modifying therapy for their field-independent patients. A similar result has been reported by Karp, Kissin, and Hustmyer (1970). In supportive therapy the therapist assumes greater responsibility for providing structure for the therapeutic process, whereas in modifying therapy the patient himself plays a part in determining the content and progress of the process.

There is still another line of evidence which shows that field-independent persons are more likely to use mediators, of their own design, in dealing with a learning task, whereas field-dependent persons are more likely to rely on characteristics of the learning task itself. This evidence comes from studies of concept attainment. Two main kinds of theoretical models have been traditionally used to describe the process of concept attainment. One model assigns an active role to the learner; the learner forms an hypothesis as to what the concept may be, and

he then tests the hypothesis by applying it to exemplars of the concept class. If the hypothesis is found wanting, a new hypothesis is formulated, following some strategy of search for the correct concept. In this view, the hypothesis formulated by the learner, and the rules which govern the sequence of hypotheses he adopts, are both regarded as learning mediators. The hypothesis-testing model of concept attainment has been intensively studied by Bruner, Goodnow, and Austin (1956), among many others. In the second model of concept attainment the learner is conceived to have a more passive or spectator role. As each new example of a concept is encountered, the constant relevant features of the concept class gradually emerge and the more variable, irrelevant features of the examples wash out (Woodworth, 1938). This view of concept attainment postulates the use of neither mediating hypotheses nor hypotheses-testing strategies.

If the use of mediators is indeed more characteristic of field-independent than field-dependent people, we would expect that the former would attempt to use an hypothesis-testing approach and the latter a spectator approach to concept attainment. The results of a study by Nebelkopf and Dreyer (1973) provide support for this expectation. These investigators studied the shape of learning curves of field-dependent and field-independent subjects in a concept-attainment task. Their field-independent subjects showed no significant change in accuracy from trial to trial for a period of time, but then a sudden improvement in performance occurred as the criterion was achieved. Such discontinuity suggests the use of an hypothesis-testing approach. While incorrect hypotheses are being considered and discarded, there is no improvement in performance; at the point where the correct hypothesis occurs, improvement takes place. In contrast, the learning curves for field-dependent subjects showed gradual improvement in performance from trial to trial, an outcome to be expected from the use of a spectator approach to the concept-attainment task.

It is important to point out that effective learning may take place by either an hypothesis-testing or a spectator approach. Thus, in the data of Nebelkopf and Dreyer there was no significant difference between field-dependent and field-independent subjects in number of trials required to attain the correct concept. Here, as in many other circumstances, field-dependence-independence appears to be more related to the "how" than to the "how much" of cognitive functioning.

It is also important to emphasize that the tendency of field-dependent persons to favor a spectator over an hypothesis-testing approach is found under conditions where both options

are available. In most concept-attainment studies, however, the subject is implicitly directed to an hypothesis-testing approach. This is done, for example, by giving the subject a set of hypotheses from which the concept is to be drawn or by asking the subject to attempt to identify the concept after each trial. When encouraged by these methods to learn concepts through an hypothesis-testing approach, field-dependent subjects are able to do so. As we shall see in the next section, however, when they do use an hypothesis-testing approach they seem to form hypotheses on a different basis than do field-independent persons.

The evidence we have reviewed suggests that their lesser use of structuring as a mediator may handicap field-dependent students in unstructured learning situations. There are probably many classroom situations where, because the material to be learned is not clearly organized, the field-dependent student may be at a disadvantage. Field-dependent students may need more explicit instruction in problem-solving strategies or more exact definition of performance outcomes than field-independent students, who may even perform better when allowed to develop their own strategies. Attention to cognitive-style differences in learning under more structured and less structured conditions, and detailed analysis of the problem-solving skills and strategies assumed for different learning tasks, are necessary.

Cue Salience

It is clear that, in the formation of hypotheses about the nature of the concepts to be learned, noticeable cues are, in general, more likely to be used than cues that are not very noticeable (for example, Bruner et al., 1956). It is equally clear that concepts defined in terms of more salient cues are generally easier to learn than concepts defined in terms of less salient cues. Now field-dependent persons, as we have seen, are particularly responsive to the dominant arrangement of the field as given and are not very likely to depart from that arrangement. On this basis, we may expect the effects of cue salience to be more pronounced for field-dependent than field-independent concept learners. A variety of evidence is consistent with this expectation.

In the typical concept-attainment problem the subject is presented with a series of complex stimuli, some of which are exemplars and others nonexemplars of the concept to be learned. For each stimulus the subject guesses whether it is an exemplar and is then told by the experimenter whether his guess is correct or not. This procedure continues until the subject reaches some criterion of success in his guesses. It has been shown in several studies that in this kind of task field-dependent learners, in

constructing their guesses, tend to ignore some (presumably nonsalient) attributes. In contrast, field-independent learners tend to sample more fully from the array of cues objectively available for concept definition (Dickstein, 1968; Kirschenbaum, 1969; Shapson, 1973). In view of this difference in cue-sampling behavior, it might be expected that field-independent people would learn concepts more rapidly when the salient cue is irrelevant to the definition of the concept. The evidence from many studies is consistent with this expectation (Goodenough, 1976). The case in which the relevant cues are salient is particularly interesting, because of the possibility that field-dependent people may learn more rapidly than field-independent people under such circumstances. The evidence on this point is scanty, but a few studies in which field-dependent subjects tended to learn concepts more rapidly than field-independent subjects may have involved relevant cues which were salient (Ruble & Nakamura, 1972; Zawel, 1970).

If certain cues have a history of relevance in the experience of the learner, their salience may be enhanced. Correspondingly, cues which are nonrelevant to the learner's experience may become less salient. One may therefore expect that field-dependent people would have particular learning difficulties under conditions in which cues useful for one concept definition become irrelevant in the context of a new learning problem. The evidence suggests that field-dependent people do indeed have difficulty breaking learning sets of this sort (Ohnmacht, 1966; Zawel, 1970).

The relationship between field-dependence-independence and concept attainment is of particular concern to educators because of their interest in having students learn concepts, rather than facts alone. It is therefore natural to ask how field-dependent students may be aided to overcome their domination by salient cues. There are some suggestions in the experimental literature as to the aids to cue usability that may be effective in teaching concepts to field-dependent learners (Shapson, 1973). Reports of attempts to develop such aids for application in classroom settings are beginning to appear in the literature but these attempts have not yet been successful (Dickie, 1970; Grippin, 1973; Nelson, 1973).

We have noted that cognitive styles tend to be stable over time. However, many behaviors that emanate from cognitive styles are far more malleable. Thus, as we have seen, although field-dependent persons tend to favor a spectator approach to concept attainment and field-independent persons an hypothesis-testing approach, it seems easily possible to induce field-dependent persons to use an hypothesis-testing approach by as simple a

means as providing directions to use such an approach. We have also seen that when using an hypothesis-testing approach field-dependent persons may be more strongly guided by salient features of the stimulus array than field-independent persons, who sample the array more extensively. Here again there is some suggestion, though hardly yet proof, that field-dependent persons may be helped in overcoming their tendency to adhere to what is salient.

The case seems well documented that relatively field-dependent and field-independent persons tend to favor different learning approaches. The approaches favored by the one kind of person do not necessarily make for better achievement than the approaches favored by the other kind. Whether one approach will lead to a better learning outcome than others seems to depend rather on the specific characteristics of the learning tasks and the particular circumstances under which learning takes place. It is not unreasonable to expect that as teachers become more aware of the ways in which relatively field-dependent and field-independent students learn concepts, they may become more effective in adapting instructional procedures to the needs of these different kinds of students. Beyond encouraging teachers to adapt their teaching to students as they find them, we may hope even more that teachers may find ways of helping students diversify their learning strategies. The apparent malleability of learning strategies flowing from cognitive styles gives some encouragement to this hope.

How Teachers Teach

Research on the role of teachers' cognitive styles in their approach to teaching has, for the most part, used the social versus-impersonal orientation and sense-of-separate identity aspects of the articulated-global dimension as points of departure for investigating classroom behavior of teachers with contrasting styles. The characteristics relevant to the teaching situation which stem from a more social or more impersonal orientation include extent of interest in interaction with others and in more social or more abstract curriculum content. The characteristic most relevant to teaching which stems from sense of separate identity is the extent to which the teacher is likely to assume responsibility for directing the teaching situation or to share this responsibility with students. Studies of teachers' preferences and of teachers' behavior in simulated teaching situations provide evidence of the expected differences in these characteristics between more field-dependent and field-independent teachers.

This evidence indicates, first of all, that whereas relatively

field-dependent teachers favor teaching situations that allow interaction with students, more field-independent teachers prefer teaching situations that are impersonal in nature and oriented toward the more cognitive aspects of teaching. As one finding, class discussion has been judged by more field-dependent teachers to represent better teaching and to be more effective for learning. A discussion approach, it should be noted, not only emphasizes social interaction, but it also gives the students more of a role in structuring the classroom situation. Wu (1968), for example, found that more field-dependent student teachers in social studies ranked discussion as more important to the practice of good teaching than either lecture or discovery approaches, which were favored by more field-independent teachers. Both lecture and discovery approaches reserve to the teacher much of the organization of the learning situation, either through facilitating and guiding student learning or through providing information.

Results from a recent study by Moore (1973) of patterns of verbal teaching behavior may perhaps also be seen as bearing on the issue of teacher directiveness. Moore used a simulation game devised to investigate differences in teachers' use of rules, relations and examples in explaining chemistry subject matter and questioning students on the content. The results suggest that the more field-independent teachers tended to use questions as instructional tools more frequently than the field-dependent teachers. Field-independent teachers tended to use questions in introducing topics and following student answers, whereas the more field-dependent teachers used questions primarily to check on student learning following instruction. Since verbal intervention was restricted and student responses very limited, discovery or discussion techniques could not be employed by the teachers. The kind of questioning approach used by the more field-independent group may be seen as the main avenue for teachers to attempt translation of a discovery approach within the context of the game.

Additional data on teacher roles were obtained by Emmerich in our study of the role of cognitive style in the teaching-learning process mentioned earlier. After teaching students in the minicourse, experienced social studies teachers who were field dependent reported feeling that class discussion was an effective technique for enhancing the learning of students. Particularly indicative of the field-dependent teachers' effort to involve students in organizing the content and sequences of the teaching-learning process is Emmerich's additional finding that field-dependent teachers (but not field-independent ones) felt encouragement of students to set up a group standard to be a useful

teaching practice. Correspondingly, teachers' statements about effective teaching techniques suggest that the field-dependent teachers were more student-centered in their approach. In contrast, students reported that field-independent teachers more frequently emphasized teachers' standards.

Another finding of Emmerich's, on teachers' preferences for different kinds of reinforcement, also seems consistent with expectations on teacher directiveness. Field-independent teachers, but not field-dependent ones, felt that informing the student when a response was incorrect and, in addition, telling him why it was incorrect, was effective in enhancing student learning. Obviously, corrective feedback provides the student with information for improving his own performance. In their use of such feedback, field-independent teachers may be seen as using a teaching approach in which they themselves organize and guide student learning. Field-independent teachers also described themselves as considering negative evaluation (that is, expression of displeasure when a student performed below capacity) to be an effective teaching technique. That both corrective feedback and negative evaluation, which involve making critical comments about another person, should be emphasized by field-independent, but not by field-dependent teachers, is consistent with the evidence from several recent studies that field-dependent persons are less likely to express (and perhaps even to feel) hostility toward other persons than field-independent persons (Bogo, Winget, & Gleser, 1970; Greenfield, 1969; Ihilevich & Gleser, 1971; Witkin, Lewis, & Weil, 1968). This difference has been interpreted in terms of the greater sense of separate identity of field-independent people (Witkin, Lewis, & Weil, 1968); the field-dependent person's greater reliance on others for self-definition makes it a problem for him to antagonize others.

Probably also reflecting the greater interest of field-independent people in the abstract and theoretical, as well as in structuring, is Emmerich's finding that students of field-independent teachers perceived these teachers as encouraging students to apply principles; in contrast, field-dependent teachers were more often seen as teaching facts.

The differences observed in preferred teaching techniques and in teaching under simulated teaching conditions suggest that field-dependent and field-independent teachers may conduct their classes differently and show different patterns of actual teaching behavior in the classroom. So far, only two studies of classroom teaching behavior, in relation to field-dependence-independence of teachers, have been reported. These studies are, however, too limited in the teaching variables explored to be informative about teaching differences. In the first study, En-

gelhardt (1973) employed Hall's observation schedule (Instrument for Analysis of Science Teaching) to observe elementary school student teachers in a minicourse setting. No relation was found between field-dependence-independence and intensity of teaching, style of teaching (student-centered or teacher-centered), or consistency of teaching style. Unfortunately, only results relating to these summary teaching variables are reported, leaving open the possibility that teachers of differing cognitive style may have differed in more specific teaching behavior. In the second study, Ohnmacht (1967a) also found no relation between field-dependence-independence and direct or indirect teaching, as defined by Flanders Interaction Analysis summary scores. Again, the relation of cognitive style to particular types of teaching behavior (for example, praise, criticism, use of student ideas, questioning, lecturing) is not reported. In addition, the research by Ohnmacht (1967b, 1968) suggesting that field-dependent, high-dogmatic men may be less stimulating and imaginative in their teaching than other teachers was not supported when classroom data from Flanders Interaction Analysis scale were considered (Ohnmacht, Note 7). In summary, then, little is yet known about differences in actual classroom teaching behavior of more field-dependent and more field-independent teachers.

Clearly, work is needed to determine whether the differences in teaching preferences and in teaching behavior between relatively field-dependent and field-independent teachers, observed under the special research conditions of the studies reviewed, are representative of cognitive-style differences in actual classroom teaching. Beyond that, there is the large research task of examining in more detail the relations that have been identified in order to determine the processes underlying these relations. In addition, implications of cognitive styles for aspects of teaching to which they have not yet been applied need to be pursued. One example is the way in which tendencies toward a more articulated or more global way of processing information enters into teachers' construction both of their communications to students and their responses to students' communications.

Several principles suggested by the evidence reviewed here, and by other evidence, are worth keeping in view in considering further lines of research.

First, whatever differences there may be between teachers of contrasting cognitive styles, such teachers do not seem to differ in sheer teaching competence. Taking student achievement as the product of the teacher's teaching efforts, students of field-dependent and field-independent teachers in our study of cognitive style in the teaching-learning process were not significantly

different in their total post minicourse test scores. Neither were the students different in their overall scores on a test of expressed interest in the subject matter of the course at the course's end. The differences between field-dependent and field-independent teachers seem to lie rather in their approach to the teaching situation, the consequences of which are not likely to be detected in gross student achievement indices. For example, through a discussion approach which their social orientation seems likely to favor, field-dependent teachers can employ personal conversational techniques to engage students in a learning situation and to develop rapport with students. Class discussion is also likely to give students more of a sense of participation in setting standards and goals and influencing coverage of class material. Through the use of such approaches, field-dependent teachers may show strength in establishing a warm and personal learning environment. In contrast, because of their particular cognitive and personal characteristics, field-independent teachers may show strength in the organization and guidance of student learning. These observations inevitably bring to mind the question of the compatibility of these different teaching strengths with the needs of different kinds of students. This is a question we consider in the next section.

If future research demonstrates differences in teaching approaches in the classroom itself, related to differences in teachers' cognitive styles, the question will then arise whether teachers are able to adopt teaching approaches, other than those fostered by their cognitive styles, in order better to meet the needs of a particular student. This issue of teacher adaptation has not yet been investigated, but some evidence from research on therapy (Witkin, Lewis, & Weil, 1968) suggests that this line of research may be a fruitful one. While frequency of therapist interactions tended to relate to therapist cognitive style in that study, it was also found that therapists intervened significantly more often with their field-dependent than their field-independent patients. We now understand this difference to be due to therapists' adaptation to differences in their patients' need for structuring, following from differences in patients' cognitive styles. An analysis of therapists' utterances, not included in the published report of the study, showed that each therapist, whatever his own cognitive style, asked more specific questions, answerable by "yes" or "no," of his field-dependent than his field-independent patient, and more open-ended questions of his field-independent than field-dependent patient. The patient's options in answering the first kind of question are minimal and clear-cut, so structuring of responses is not particularly required. This makes such questions appropriate to the

field-dependent patient's lesser use of structuring. In contrast, open-ended questions, by leaving more options to the patient, and so requiring the patient to take more responsibility for structuring his responses, seem appropriate to the cognitive makeup of field-independent patients. It is noteworthy that, whatever cues they used, therapists proved able in the very first session of therapy to identify the needs of their patients, stemming from the patients' cognitive styles, and to adapt the form of their questions accordingly.

Another example of the ability of therapists to make adjustments to the cognitive styles of their patients comes from the finding that therapists more often favor supportive forms of therapy for their field-dependent patients and modifying forms of therapy for their more differentiated patients, as noted earlier. Considering the modes of interaction involved in these two therapeutic approaches, it seems that therapists, very early in their encounters with their patients, choose to enter into quite different sorts of interpersonal relations with these two kinds of people.

We may wonder whether teachers show similar adaptation to their students' needs. We may wonder as well whether there are individual differences among teachers in the ease with which they are able to determine that a shift from the teaching approach fostered by their cognitive styles is required and then to make the shift. And we may ask as well whether, by sensitizing teachers to the implications of their own cognitive styles and the styles of their students for the teaching-learning process, we may increase the adaptability of teachers, so they become more diversified in the teaching approaches they use. The evidence considered earlier that people can rather easily be made to use learning approaches other than those fostered by their cognitive styles makes it plausible to believe that, with appropriate training methods, teaching approaches may also be diversified.

How Teachers and Students Interact

In the studies reviewed to this point the role of students' cognitive styles in their learning behavior and of teachers' cognitive styles in their teaching behavior have been considered apart from each other. For the classroom, where teachers and students are engaged in a continuous, interactive dialogue, which constitutes the integral teaching-learning process, studies of the combinatory effects of the cognitive styles of both contributors to this process are likely to be even more informative. The full contribution of cognitive style to any social interaction is more than the sum of the effects of each participant's style.

Interactions acquire unique properties which are emergents of the particular combination of characteristics of the individuals involved. This principle has been shown to operate in the case of cognitive styles. To date studies of the combinatory effects of cognitive styles have focused mainly on the progress and outcome of an interaction when its participants are matched or mismatched in cognitive style. The match-mismatch issue has been examined in three studies of teacher-student interaction.

DiStefano (1970) used as subjects teachers and students in a regular classroom situation. He found that, in their responses to several questionnaires, teachers and students matched to each other in style viewed one another positively, whereas teachers and students who were mismatched viewed each other negatively. It is noteworthy that the positive and negative evaluations included not only personal characteristics but cognitive characteristics as well. In another study, James (1973) used a specially created minicourse in which each teacher taught a class of three field-dependent and three field-independent students. Responses to questionnaires similar to those used by DiStefano confirmed DiStefano's finding of significantly greater interpersonal attraction in matched than in mismatched teacher-student combination. In addition to obtaining questionnaire data, James asked each teacher, at the end of the course (but prior to the final examination), to assign grades to his six students on the basis of their classroom performance. The most extremely field-independent teacher gave all three of his field-independent students higher grades than the three field-dependent students. Conversely, the most extremely field-dependent teacher assigned the three highest grades to his three field-dependent students.

Since the grades assigned by teachers in the James study were based on classroom impressions, they undoubtedly reflect, in some degree, the effects of interpersonal attraction. In the DiStefano study, the questionnaires used for student evaluations focused even more directly on the teachers' attitudes and feelings toward the student. It thus seems reasonable to interpret both the DiStefano and James findings as demonstrating that teacher-student match in cognitive style makes for greater interpersonal attraction than mismatch. It is also possible that teachers' higher evaluation of students similar to them in cognitive style may have reflected better student performance, but since only teacher estimates of student achievement were available in these studies, this possibility has not been clearly demonstrated. Yet, it is a possibility that seems quite reasonable. The concept, made plausible by common sense and experience, that particular teachers do better with some students than others,

may apply here as well; teachers may indeed do better with students similar to themselves in cognitive style, and students may learn more effectively when taught by teachers matched to them in cognitive style.

The third study of teacher-student cognitive style match-mismatch effects is one, already mentioned, we ourselves conducted in collaboration with Walter Emmerich, Philip Oltman, and Frederick McDonald. For that study a four-session minicourse was organized, using a curriculum designed to allow expression of likely subject-matter and teaching-technique preferences of field-dependent and field-independent teachers and subject-matter and learning-strategy preferences of field-dependent and field-independent students. Each of 24 teachers (12 men and 12 women, six of each sex field dependent and six field independent) taught this minicourse. Each class consisted of four 14- to 15-year-old students, two boys and two girls, one student of each sex field dependent, the other field independent. Teacher and student responses to postcourse interpersonal attraction questionnaires did not show the expected teacher-student cognitive-style match-mismatch effect. Instead, a teacher-student sex match-mismatch effect was observed. With these adolescent students, it was found that teachers and students of the same sex valued each other more highly than teachers and students of the opposite sex. Apparently, the sex match-mismatch effect was more potent and took precedence over the cognitive-style match-mismatch effect. It should be noted that while the design of our study allowed a sex match-mismatch effect to occur, the DiStefano and James studies did not: DiStefano used male teachers and male students, and James used male teachers and female students.

Though up to this point there have been only these three studies of teacher-student match-mismatch effects, cognitive style match-mismatch effects have been observed in other social-interaction contexts—in patient-therapist interactions (Folman, 1973; Greene, 1972) and in peer interaction (Welkowitz, Note 8)—although it was not found in a study of client-counselor interaction (Dingman, 1972).

The studies cited, together, suggest that cognitive-style match-mismatch effects on interpersonal attraction are generally to be found in social interactions where participants are working together toward a common goal.

Several bases are suggested by the literature on field-dependence-independence for the tendency of persons matched in cognitive style to like each other better and, perhaps, to make greater progress in achieving the goal of the interaction, whether that goal is better learning by students or improved

feelings in patients. One basis is shared interests. It is not difficult to see, for example, how the social orientation of field-dependent persons and the impersonal orientation of field-independent persons could cause matched pairs, when they come together, to focus quite spontaneously on the same aspects of a situation at issue, thereby heightening the facility and enjoyment of their interaction. A second possible basis for greater interpersonal attraction between individuals of similar cognitive style may lie in their shared personality characteristics (for example, Witkin et al., 1954/1972; Witkin et al., 1962/1974). Thus, the defenses favored by relatively field-dependent persons and relatively field-independent persons are likely to make for similarity, and hence congeniality, among persons of each kind in mode of impulse expression and in responses to feelings displayed by others. A third possible basis for the greater interpersonal attraction observed between persons matched in cognitive style may lie in similarity in modes of communication (for example, Doob, 1958; Freedman, O'Hanlon, Oltman, & Witkin, 1972; Jennings, 1968; Marcus, 1970; Shows, 1968; Luborsky, Note 9). That similarity in communication modes deriving from cognitive style may facilitate understanding is suggested by the results of a study by Shows (1968). In that study two verbal descriptions of a series of pictures were prepared consisting of adjectives selected by a group of judges as likely to be employed by field-dependent and field-independent persons. Subjects did significantly better in matching verbal description to picture with descriptions prepared as corresponding to their cognitive style. It seems plausible that interaction between people should proceed more smoothly, and mutual feelings between them should be more positive, when, as a function of similarity in style, they share the same interests, have common personality attributes, and use similar communication modes.

It is impressive that in some of the studies cited interpersonal-attraction effects were observed after short periods of interaction. Evidence of such effects might have been found even earlier in the interaction process had it been sought. It is also impressive that people not knowledgeable about cognitive styles, and naive with respect to the particular styles of those with whom they are interacting, should respond quite naturally, and with apparent ease, to cues about other people's field dependence or field independence. Evidently, some behaviors associated with these cognitive styles are salient and obvious to all.

The evidence now on hand has established match or mismatch in cognitive styles as a factor in teacher-student and other kinds of social interaction as well. To have demonstrated that a

match-mismatch phenomenon exists is to have opened the door only a crack. What is already visible through that crack suggests, however, that we may find much of interest behind it for the teaching-learning process. There are many basic questions to be answered before we can even begin to consider the practical implications of the match-mismatch phenomenon for the classroom situation. These questions, fortunately, are all answerable by research.

The first and foremost question is whether matching for cognitive style makes for better student learning, and not alone for the greater interpersonal attraction that has been demonstrated to this point.[8] On the one hand, it is possible to see ways in which teacher-student match may have a positive learning outcome. For example, it may well be that the greater interpersonal attraction between teachers and students matched in cognitive style creates a classroom atmosphere conducive to learning. Also congenial to each other are the tendency of field-independent teachers to encourage the application of principles and of field-independent students to favor the theoretical and abstract, and, correspondingly, of field-dependent teachers and students to favor material that is informational in content. Again, the field-dependent teacher's preference for classroom discussion may provide the kind of social context suited to the personal needs of field-dependent children. On the other hand, it is equally possible to conceive of negative consequences of matching. As one example, it may be that for some kinds of learning content a contrast in styles between teacher and student may be more stimulating than similarity. In general, because heterogeneity makes for diversity in viewpoints and responses, it may serve to make the classroom more lively; if so, homogeneous classes may be ill-advised. As another example, while the interpersonal effects of the discussion approach used by relatively field-dependent teachers may be helpful to learning by field-dependent students, that very approach at the same time minimizes structure from the teacher which field-dependent students seem to need for most effective learning. As still another example, we have seen that relatively field-independent teachers are likely to use negative reinforcement in the classroom, but it is the more field-dependent student who is particularly responsive to this technique, although, depending on circumstances, its effect on learning may be positive or negative. There is a similar "disparity" in the more field-independent teacher's tendency to provide feedback and the field-dependent child's benefit from feedback as a source of structuring. The possibilities that have been listed reflect the complexity of the relation between cognitive style match-mismatch and student achievement, and they provide a strong note of caution against deciding about the desirability of matching before a great deal more is known as to the consequences of matching for student learning. An added note of caution is suggested by the obvious practical problems likely to be encountered in attempting to create classes of students homogenous in cognitive style and matched in style with their teacher.

[8] The study by Folman (1973) has shown that match in cognitive style may lead to patient improvement, as well as to greater patient-therapist interpersonal attraction. Folman found that patient dropout rate, a commonly used achievement criterion in therapy studies, was lower for patients from matched than from mismatched patient-therapist dyads.

As a second question, we need to find out how match or mismatch in cognitive style works to produce the effects observed. For this purpose, a microscopic examination needs to be made of the processes of teacher-student interaction which lead to a more positive outcome in interpersonal attraction (and perhaps in better learning) with match than with mismatch.

A third question that needs to be answered concerns the role of situational variables in moderating the effects of match or mismatch in cognitive style. The operation of such moderator variables has recently been demonstrated by Oltman et al. (1975) in a study of conflict resolution. It is not difficult to think of variables specific to the classroom situation which may modify the effects of teacher-student cognitive style match-mismatch effects. As one example, just noted, in our study of cognitive style in the teaching-learning process, match or mismatch in sex of student and teacher had such a potent effect on mutual attraction for the high-school-age population we used as to obscure the effects of cognitive-style match-mismatch. Another classroom variable that could modify cognitive-style match-mismatch effects is course curriculum. In areas where good student performance requires highly specialized skills, the availability of these skills may overwhelm cognitive-style match-mismatch effects.

In using studies of cognitive-style match-mismatch effects as a route to understanding what goes on in the classroom, it is the teacher-student interaction process which is made the focus of inquiry; at the same time, account is taken of individuality and diversity of teachers and of students. The broad approach they follow is likely to make teacher-student match-mismatch studies informative about the classroom situation, whatever their ultimate implications for placement of teachers and students. One practical use of knowledge about the effects of teachers' and students' cognitive styles, studied in interaction, may be to provide teachers with information on how to adapt their teaching strategies to match the learning needs of dissimilar students.

Teachers' adaptation will be a realizable goal if we are able to identify particular teaching strategies which teachers may use, either spontaneously or with training, when teaching students with different cognitive styles.

Career Differentiation

There is now a growing body of evidence on the role of cognitive style in career differentiation. One reason for the increasing interest in this issue is that, particularly because of their bipolar nature, cognitive styles provide an alternative to the usual abilities approach to career differentiation. The complementary use of information about abilities and cognitive styles seems likely to provide a rich and broad basis for making career decisions.

Precisely because of their bipolar nature, cognitive styles are, generally speaking, more useful in guidance than in selection. Admissions committees, faced with the task of selecting groups as heterogeneous as a college class, seek measures which can be used to separate those more likely to make it through college from those less likely to make it. For such general-purpose efforts, bipolar dimensions, such as cognitive styles, are not particularly useful. Cognitive styles, as we have seen, emphasize the ways in which persons towards one pole or the other are different with regard to the settings in which they can best function. One circumstance in which cognitive styles may prove useful in selection, however, is where candidates are being chosen for a rather specialized situation, which specifically calls for the attributes found towards one pole or the other of the style.

Consistent with the ideas that general-purpose selection, as in composing an entering college class, is not "where it is at" for cognitive styles is the repeated finding that measures of field-dependence-independence bear little relation to college grade-point average. This relation has been examined in a number of studies conducted in a liberal arts college setting, and, with only rare exceptions, the correlations obtained were not significant (for example, Anderson, 1972; Gehlmann, 1951; Glass, 1967; Montgomery, 1972; Pohl, 1967).[9] The largest of these studies, a longitudinal one we ourselves are conducting with a sample of college students, yielded correlations of only .08 for men ($N = 583$) and .05 for women ($N = 633$) between measures of field-dependence-independence and four-year college grade-point averages.[10,11] Relatively field-dependent and field-independent

[9] In one study (Baker, 1971), no relation was found at the graduate-school level.

[10] Verbal ability, in contrast, does appear to relate to college grade-point average. Thus, in our longitudinal study the correlation of verbal SAT scores with college grade-point average was .37 for women ($p < .001, N = 633$) and .33 for men ($p < .001, N = 583$). In two other studies, verbal SAT scores significantly predicted college grade-point averages, while measures of field-dependence-independence did not (Pohl, 1967; Stein, 1968). In a fourth study, ETS Cooperative English Test scores also significantly predicted grade-point average, but field-dependence-independence measures did not (Glass, 1967).

students are clearly not particularly different in how they come through college on an overall achievement measure such as grade-point average. However, as we shall see, they are likely to be different in the mix of courses they select in which the essentially same grade-point averages are earned (Witkin, Moore, Oltman, Goodenough, Friedman, & Owen, Note 10).

The evidence we draw upon in examining the role of cognitive style in career differentiation comes primarily from the literature that has accumulated over the past few years. Supplementing that evidence are the results now emerging from our own longitudinal study, just cited. The population of that study was the entire class of approximately 1600 students from a large municipal college. On entering in 1967, these students were assessed for cognitive style, and we were able to obtain their full high-school transcripts, their SAT scores, and other kinds of information about them. Four years later we obtained the complete college transcripts of those who made it through to graduation. Those in the class who went on to graduate or professional schools were identified, and information obtained about their movement into postgraduate work. This study thus provides an opportunity to pursue the implications of an individual's cognitive style for various facets of his academic development over a 12-year period: through high school, college and graduate/professional school. It is an obvious advantage of the longitudinal design of this study, over cross-sectional studies, that it allows us to trace the long-range academic evolution of the same students.

[11] There seems to be somewhat more of a relationship, though not a strong one, between field-dependence-independence and grade-point average at the high-school level (for example, Acker, 1968; Cline, Richards, & Abe, 1962; Mayer, 1967; Quinlan, 1971) and a rather definite relation at the elementary school level (for example, Cropley, 1966; Erginel, 1970; Frederick, 1967; Wagner, 1974). The difference between the elementary school and college levels may be connected with the difference between the usually compulsory curriculum at the elementary school level and the elective curriculum at the college level. To the extent that an elective system allows students to gravitate toward courses compatible with their cognitive styles, and to the extent that students, as we shall see, tend to do well in courses they have thus selected, there is less likely to be a relation between cognitive style and achievement in an elective setting. In a nonelective curriculum, field-dependent students are likely to be penalized in that part of the curriculum which calls for analytic skills, such as mathematical and scientific subjects. On the other hand, field-independent students are not as likely to be penalized in the social sciences domain because courses in that domain are, as we shall suggest later, often "broad-gauge" disciplines.

As we turn to an examination of the evidence on the role of cognitive style in specific facets of career differentiation, it is important to emphasize again that when using cognitive style to predict behavior, we are able to rest our predictions on a *cluster* of characteristics subsumed by that style. Within that cluster, some characteristics may be highly relevant to a particular educational-vocational domain and other characteristics not particularly relevant.

Educational-Vocational Interests

The results of the very large number of studies that have examined the relation of educational-vocational interests and attitudes to field-dependence-independence present a picture that, by and large, is in keeping with expectations (for example, Arbuthnot & Gruenfeld, 1969; Chung, 1967; Crutchfield et al., 1958; Keen, 1974; Pemberton, 1952; Scheibner, 1970; Zytowski, Mills, & Paepe, 1969). As a general principle, relatively field-independent persons, taken as a group, are likely to show interest in domains where their cognitive skill—competence in articulation or in analysis and structuring—are called for and where relations with people are not particularly involved. In contrast, relatively field-dependent persons, as a group, are likely to favor domains with a "people" emphasis—that is, which feature social content and which involve interpersonal relations in daily ongoing activities—and for which analytical/structuring competence does not particularly matter. This pattern has emerged with a fair degree of regularity in the studies done to date on educational-vocational preferences, though there are exceptions. We review now some of the findings which illustrate these generalizations.

Since most of the studies used the Strong Vocational Interest Blank, or similar instruments, the relationships that have been reported are almost entirely between cognitive style and interests defined in vocational terms.

It has been found repeatedly that the responses of more field-independent people to standard interest inventories are consistent with those of people in the mathematics and science domains—as, for example, mathematician, physicist, chemist, biologist, architect, engineer—and of such health professionals as physician, dentist, psychiatrist. In some studies field-independent persons have also shown interest in the teaching of mathematics-science, industrial-arts and vocational-agricultural subjects. These teaching areas, as well as the health-profession areas cited, all require analytical/structuring competence (for psychiatrists, perhaps more during their training than during their medical practice), and, although these areas may also

involve interpersonal relations in varying degree, they tend to go with field independence. Field-independent persons also show interest in practical domains, such as production manager, carpenter, forest service, farmer, mechanic (for example, Gehlmann, 1951; Levy, 1969; Pierson, 1965), and they give clear evidence of theoretical interests (for example, Adcock & Webberley, 1971; Pemberton, 1952). There is finally a result for which we did not have an advance hypothesis but which is worth noting because it has appeared in a number of studies: field independence is associated with artistic interest (for example, Clar, 1971; Crutchfield et al., 1958).

In contrast with the preponderant interest of field-independent persons in the analytical-impersonal domains listed above, field-dependent persons express interest in interpersonal domains that particularly require social skills. One cluster of interests they frequently express falls in the welfare-helping-humanitarian domain, including social worker, minister, rehabilitation counselor, probation officer. Another is the teaching of social sciences, elementary-school teaching, and business administration. It is noteworthy that the teaching and health-profession areas we find here on the field-dependent side do not involve analytical competence, in contrast to their teaching and health-profession counterparts found on the field-independent side, although all these occupations involve interpersonal relations to some degree. Other vocational interests frequently expressed by field-dependent persons fall into the "persuasive-activities" domains (selling, advertising) and administrative activities which involve dealing with people (for example, personnel director, community recreation administrator, YMCA public administrator, city school superintendent, and chamber of commerce director).[12]

With the view that the analytical-nonanalytical and impersonal-interpersonal dimensions best distinguish the expressed interests of relatively field-dependent and field-independent persons, Clar (1971) applied these dimensions to the data from her study of the Strong Interest Inventory responses

[12] It is of interest that field-dependent persons may be drawn to occupations which place them in a position of leadership. The association of interests in social leadership with field dependence and, as we just saw, of "practical" interests (such as mechanic, farmer, carpenter, forest serviceman) with field independence, suggests that the conventional social-status values of occupations do not, in any simple way, distinguish the interests of relatively field-dependent and field-independent persons. As we shall see, this is also true of educational-vocational choices. Thus, academic majors such as the humanities and sociology, which tend to be favored by relatively field-dependent students, are not easily classified as having greater or less status than the sciences, favored by field-independent students.

of these two kinds of persons, with striking results. Clar created four interest categories on the basis of these two dimensions, with six vocations in each category. The impersonal-analytical category included chemist, mathematician, biologist, engineer, physicist, and artist. The interpersonal-nonanalytical category, at the opposite extreme, included social worker, personnel director, business-education teacher, chamber of commerce executive, credit manager, and community recreation director. Clar found that measures from the embedded-figures test she used to assess field-dependence-independence correlated significantly and positively with all six Strong measures in the impersonal-abstract category (more field-independent persons favored these vocations) and significantly but negatively with all six Strong measures in the interpersonal-nonanalytical category (more field-dependent persons favored these vocations). Measures for each set of six Strong measures in the two intermediate "mixed" categories (impersonal-nonanalytical and interpersonal-analytical) showed correlations which were variable, both as to direction and statistical significance, with measures of field-dependence-independence. Vocational interest measures are thus more likely to show a relation to measures of field-dependence-independence when they call for both the cognitive and social characteristics found together toward each pole of that dimension.

Several additional studies are worth mentioning because they suggest another parameter that may be involved in the relation between interests and cognitive style. In one study (Witkin et al., 1962/1974) it was found that field-dependent 10-year-old boys preferred the particular vocation most frequently chosen by their peer group. Linton (1952) similarly found that relatively field-independent college students expressed preferences for occupations that were unusual for their peer group. These findings may be taken as another manifestation of the greater reliance of field-dependent persons on external social referents.

Educational-Vocational Choices

Choices represent an actual commitment to a domain, and so are "harder" expressions of educational-vocational orientation than interests. At the same time, since both choices and interest have the same underlying sources, it is not surprising to find that educational-vocational choices show patterns of relations to cognitive style similar to those found for interests. The very large number of studies in which the relation between educational-vocational choices and cognitive style has been examined are, with only few exceptions, consistent in their outcome; and they

strongly reinforce the finding from the studies of interests that relatively field-independent persons favor impersonal domains which require competence in cognitive articulation and field-dependent persons favor interpersonal domains which do not call for that kind of cognitive competence (for example, Baker, 1971; DeRussy & Futch, 1971; Holtzman, Swartz, & Thorpe, 1971; Kangas, 1971; Mayo & Bell, 1972; Osipow, 1969; Paeth, 1973; Peterson & Sweitzer, 1973; Swan, 1974; Witkin, Moore, Oltman, Goodenough, & Friedman, Note 10).[13]

In the academic setting, relatively field-independent college and graduate students are likely to choose for specialization such fields as, for example, the sciences, mathematics, art, experimental psychology, engineering, architecture. Relatively field-dependent students are likely to choose, for example, sociology, humanities, languages, social work, social services (religion), elementary school teaching, education, clinical psychology, writing, nursing. Complementing these findings, studies of persons already engaged in occupations have shown that engineers, architects, Air Force captains, mathematics-science teachers, and airplane pilots are likely to be very field independent (Barrett & Thornton, 1967; Crutchfield et al., 1958; Cullen, Harper, & Kidera, 1969; DiStefano, 1970; MacKinnon, 1962), whereas social-studies teachers (DiStefano, 1970), social workers (Braun, 1971), and writers (MacKinnon, 1962) tend to be field dependent.

The positive orientation of field-dependent persons toward domains in which "people" content is identifiably involved may be connected with the earlier observation that such persons are attentive to and therefore more likely to learn about the social content of any situation. Their better learning of social types of material is likely, even very early on, to encourage a favorable attitude toward fields which feature such material and so foster their interest in and choice of such fields.

Interests/Choices within Educational-Vocational Domains

Congruent with the differences in educational-vocational interests and choices that have been observed *between* domains are the differences found *within* domains.

The within-domain relations have been observed in "broad-gauge" rather than "narrow-gauge" disciplines. Vocational

[13] In the Witkin et al. study (Note 10) the relations observed between cognitive style and academic choices remained significant after partialling out measures of ability from SAT-V and SAT-M, suggesting that cognitive style makes a contribution to academic choices separate from the contributions made by these abilities. We may also note here the clear evidence from the factor-analytic literature that tests of field-dependence-independence such as the embedded figures test, and tests of spatial-visualization ability load separate first-order factors.

categories such as "mathematics," "science," "architecture," "engineering," "social work," and "elementary school teaching" may be regarded as "narrow-gauge" domains, in the sense that they require particular attributes (analytical/structuring competence or a social orientation). On the other hand, categories such as "social science" are "broad-gauge" in the sense that within them there exist opportunities for persons with diverse attributes. As one might therefore expect, in the few studies where "social sciences" was used as a category, its choice tended to be associated only weakly with greater field dependence. It is for these reasons that within-category relationships between cognitive style and vocational choices are likely to be found in broad-gauge categories. The data summarized in Table 1 support this expectation. Each line in the left-hand column of the table lists the interests/choices of relatively field-dependent persons, as identified in one or more studies (for example, Chung, 1967; Clar, 1971; Nagle, 1968; Pierson, 1965; Pollack & Kiev, 1963; Quinlan & Blatt, 1972; van Meel-Jansen, 1974); in the right-hand column, on the same line, we see the interests/choices in the same educational-vocational domain of relatively field-independent individuals. Exceptions to these within-occupation contrasts are rare (Schaefer, 1973).

There are several studies which have examined cognitive styles of groups that, while generally quite field independent,

TABLE 1
Interests/Choices of Relatively Field-Dependent and Field-Independent Individuals within Educational-Vocational Domains

Field Dependent	*Field Independent*
Clinical psychology	Experimental psychology
Psychiatric nursing	Surgical nursing
Psychiatric practice favoring interpersonal relations with patients	Psychiatric practice favoring impersonal forms of therapy
Business personnel director / Business education teacher	Business production manager
Social studies teacher / Elementary school teacher	Natural science teacher / Industrial arts teacher
Art students with informal art style	Art students with formal art style

proved to be significantly different from each other in extent of field independence. Thus, systems engineers have been found to be more field independent than nonsytem engineers (Nussbaum, 1965), and student pilots in a naval officer training program more field independent than student nonpilots (navigators, radar intercept operators, etc.) (Kennedy, 1972). Also relevant here is a study by Rosett, Nackenson, Robbins, and Sapirstein (1966) which showed that engineering students with exclusive science interests on the Thurstone Interests Schedule were significantly more field independent than engineering students who showed, in addition, interests in music, art, and business.

Achievement in Specialized Educational-Vocational Areas

We have seen that field-dependence-independence does not show much relation to overall achievement measures, such as college grade-point average. In contrast, numerous studies have demonstrated a relation between cognitive style and performance in specialized areas. The relations observed in these studies are generally consistent with expectations and, of course, with the relations reported earlier between cognitive style and educational-vocational interests and choices.

We consider, first, performance in the academic situation. By far the largest number of studies here have looked at achievement of students in the mathematics-science area, and to an extent in engineering and architecture. Achievement has most often been assessed by grades or teacher-made test scores in individual courses or clusters of courses or by scores on standard achievement tests; several studies have considered teacher's ratings of student performance, and a few have examined overall grade-point averages earned by students specializing in one of these domains, so that grades in courses in the specialty have strong representation in these averages. Subject populations sampled have included college students, high school students, and students in special training programs.

In a good majority of the large number of studies with college populations, relatively field-independent students were found to perform significantly better in the mathematics, sciences, engineering, and architecture domains than field-dependent students (for example, Dubois & Cohen, 1970; Greenfield, 1971; Hunt & Randhawa, 1973; Margulis, 1972; Rosett, Robbins, & Watson, 1968; Schmidt, 1973; Stein. 1968; Williams, 1970). In the studies where a significant relation was not found, the results were invariably in the expected direction. If we consider the successive steps involved in career differentiation, we can see when we put this finding together with observations made earlier that

relatively field-independent persons are likely to express interest in these domains, to choose them for specialization, and to perform better in them once the selection has been made. It is noteworthy that relationships between cognitive style and achievement appear despite the restricted range in cognitive-style scores likely to occur in groups filtering into these domains.

Results obtained with the Mathematics Scholastic Aptitude Test (MSAT), which are relevant here to the extent that MSAT assesses mathematical competence, merit separate consideration because of the wide use of the SAT in the educational setting. Indeed, the evidence from studies which have examined this relation is in keeping with expectations, although, for reasons not now apparent, the relation is stronger for women than for men. In all 11 studies which used women as subjects, the relation was significant; the mean of the correlations of the nine studies which used this statistic was .44. In studies with men a significant relation was found in 11 of 16 studies; and the mean of the correlations of the 13 studies which report this type of measure was .29 (for example, Abelew, 1974; Bieri, Bradburn, & Galinsky, 1958; Farr, 1969; McCaulley, 1965; McKenna, 1968).[14]

Studies of the relation between cognitive style and performance have been less frequent with high school students than with college students, and their results not as clear. In only about half of the studies with high school students now on record was the relation between mathematics-science achievement and measures of field-dependence-independence significant, although in every study, the difference in performance as a function of cognitive style was in the expected direction. Several possible bases for the difference in outcome at the college and high school levels suggest themselves. One is that the content of courses at the high school level which bear the labels "mathematics" and "science" may not rely as much on field-independent functioning for effective performance as courses carrying these designations at the college level. A second is that interpersonal attraction may enter to a greater extent in teachers' grades at the younger levels.[15]

[14] In contrast with the picture for the Mathematics SAT, in 9 studies with women, the mean correlation between Verbal SAT scores and measures of field-dependence-independence was .14; in 13 studies with men, the mean correlation was .13.

[15] Because of uncertainty about what "mathematics" encompasses at the elementary school level, we have not considered here the few studies which examined the relation of cognitive style to performance in mathematics. In two studies conducted with elementary school children, a significant relation between field independence and science performance was found in one (Sieben, 1971), but not the other (Vernon, 1972).

In contrast to the very large body of work on performance in academic domains likely to be favored by field-independent students, there have been very few studies which looked at domains where good performance may be expected to go with field dependence. This striking disparity in effort may have several bases. First, work—both conceptual and empirical—on the impersonal-interpersonal constituent of the articulated-global dimension has developed relatively recently. As it has become clear from this work that field-dependent persons are likely to have a predominant social orientation, a stimulus (and an hypothesis) is now provided for looking at performance in educational-vocational domains where such an orientation might benefit performance. Earlier, the evidence on interests and choices of field-dependent persons was the accidental by-product of the use of comprehensive inventories and course coverage, rather than the product of focused inquiry. Another possible reason for less research on performance of field-dependent persons in areas where they may be expected to do well is that it is more difficult to develop adequate tests of achievement in these areas, which are less delineated in content and less easily defined as to the processes they involve than tests in the mathematics-science domain.

In the present state of the evidence, we may say that there has not yet been a real check on the expected relation between field dependence and better performance in educational domains where a social orientation is emphasized. What little evidence there is suggests that investigation of this relationship will require careful delineation of specialties. This is because, as we have suggested, in a number of instances the specialties to which field-dependent persons are drawn are constituents of broad-gauge disciplines. Psychology is an example, and we may recall here the finding of Nagle (1968) that graduate students in clinical psychology tend to be field dependent and those in experimental psychology field independent. It seems clear that labels in the social sciences domain are likely to cover greater diversity in the kinds of subject matter they encompass than labels in the mathematics and science domains.

We consider finally achievement in *vocational* domains as a function of cognitive style. Little has been done on this issue, but the evidence available is consistent with expectations. To the extent that the supervisors' ratings of the performance of surgical and psychiatric student nurses in the Quinlan and Blatt study (1972), cited earlier, were based in part on observations in the actual work situation itself, that study is relevant here. It will be recalled that student nurses who were judged to have done well in surgery were relatively field independent, whereas

students who did well in psychiatry tended to be more field dependent. To be cited here, too, is the finding from a study by MacKinnon (1962). MacKinnon found practicing architects selected as outstandingly creative by their peers to be markedly field independent, whereas writers selected on a similar basis were quite field dependent. As a noteworthy aside, in a test of verbal ability, the two groups shifted rank among the occupational groups compared, the writers moving to a top ranking and the architects to a low ranking. Finally, we cite the finding of Kennedy (1972) that field independence was a significant predictor of success in training of the Naval Flight Officer Candidates and the Naval Aviation Officer Candidates he studied. These findings were validated in a second study. It should be cautioned, however, that the relation reported by Kennedy is quite small although, with the large number of cases he used, his results were significant.

Some of the relations reviewed in this section may be connected in an interesting though complex way to the match-mismatch issue considered earlier. We have just seen that field-independent students are likely to do better in mathematics and the sciences. We now also know that teachers who teach these subjects are likely themselves to be relatively field independent. May the better performance of field-independent students in these subjects therefore reflect, in some degree at least, a positive effect of teacher-student cognitive-style match on student achievement and/or interpersonal attraction? If research shows the answer to this question to be positive, there will in turn arise the question of whether methods of teaching mathematics and science can be devised which are more suitable for field-dependent students than the methods those now teaching these subjects are likely to favor as a function of their own field-independent cognitive style. The possibility of using appropriately different approahces in teaching mathematics to relatively field-dependent and field-independent students has recently been raised by Spitler (1971).

Making and Changing Educational Choices

Evidence is beginning to emerge that cognitive styles enter into the *process* of making career choices. The influence of cognitive styles has been identified in how careers are conceptualized, in the ease with which career choices are made, and in the shifting of majors.

Tyler and Sundberg (Note 11), in a study of ninth-grade Dutch children, explored these children's classification of occupational concepts. Among the classifications identified was one which

included such characteristics as "concrete" and "using associations rather than similarity as a basis for grouping." Children who never used this kind of classification almost all earned scores that were in a field-independent direction on tests of that dimension; the reverse was not true, however. In another study with children (eighth-grade boys) Glatt (1970) assessed "readiness for occupational planning," as judged from interviews. Assessments of readiness made use of such criteria as: awareness of factors relevant to curriculum choice and to occupational choice; accuracy of self-appraisal of cognitive abilities; and ability to verbalize strengths and weaknesses. According to ratings based on such criteria, relatively field-independent boys were found to show greater readiness for occupational planning. Clar (1971) observed that the more field-independent students attending a university counseling center showed some tendency, according to judgments of their counselors, to have more articulated vocational interests and to be more realistic in their initial vocational choices, and that there was a tendency for their vocational interests to be more specialized. In contrast, the relatively field-dependent counselees were more often definitely undecided about vocations at the termination of counseling. Clar also reports that counselees taking a more active stance toward counseling, as judged from statements made in presenting their problems, were significantly more field independent than counselees who took a passive stance. Along the same lines, it has been observed by Osipow (1969) that a group of college women admitting difficulty in making career choices and uncommitted to a course of study were significantly more field dependent than each of four other groups of women who were already enrolled in specific programs and reported experiencing greater ease in making career choices. Finally, Scheibner (1970) found that relatively field-independent college men, compared to more field-dependent men, showed better agreement between vocational interests and vocational goals. This relation was not found for college women, however.

The process of making career choices was examined in our own longitudinal study of cognitive style as a factor in academic evolution at another juncture where it may manifest itself: in abandoning a chosen major in favor of a new major. For each student we determined whether a shift took place from the major specified on college admission and the nature of the change when it occurred. In examining the subject-matter areas involved in switches in major, we looked particularly at shifts between the mathematics-science domain, clearly favored by field-independent students, and education domains, favored by field-dependent students. This analysis revealed that shifts out of

mathematics and science were especially common among the more field-dependent students;[16] the shifts serve to bring about a better fit between students' cognitive styles and their career choices.

Educational-Vocational Orientation at Early Ages

Several studies which used children as subjects suggest that cognitive style may begin to influence career differentiation quite early in life. Because early "signs" of later career development can be so very valuable in the guidance process, and yet are so rare, it is worth bringing together the evidence, some of it already cited, which suggests that field-dependence-independence may provide one such usable early sign.

We have just seen in the studies by Tyler and Sundberg and by Glatt, that, already at the eighth- and ninth-grade levels, conceptions of educational-vocational domains are more articulated among relatively field-independent than field-dependent children. Earlier development of articulated career conceptions is likely to affect progress toward career choices and manner of implementing these choices.

Several studies have examined children's orientation towards science, through questionnaires and inventories, as a function of cognitive style. The instruments used examined such features of orientation towards science as areas of interest in science, leisure-time investment in science, finding it fun "to mess around in science," and feelings toward science. Significant relations have been found between greater field independence and a more positive orientation toward science by Bowles and Boss (Note 12) for ninth-grade boys, and by Sieben (1971) for seventh-grade boys but not girls. Cline, Richards, and Needham (1963) did not find a relation for either boys or girls of high school age. Relevant to these observations is the finding by Karp (cited in Witkin et al., 1962/1974), that relatively field-dependent 10-year-old boys significantly more often chose as their eventual occupation the one most frequently selected by their peer group.

While the evidence is still sparse, it seems promising enough to encourage further research on early cognitive-style influences in the evolution of educational-vocational interests and choices.

[16] This outcome would appear to lend support to the view that the relationship found between field independence and choice of the mathematics and sciences domain is a function of field-independent people choosing these domains over the alternative view that the relationship is a result of the fact that experience in these domains makes people field independent.

Sex Differences

The well-documented evidence of small but persistent sex differences in field-dependence-independence among adults suggests that it may be useful to examine the interests-choices-performance domains, in relation to cognitive style, for men and women separately. The studies reviewed in the preceding sections indicate that, in general, the role of cognitive style in each of these domains is similar for men and for women. There is also evidence, however, only now beginning to appear, that sex-role assignment, particularly among women, may override the effects of cognitive style on career differentiation that we have been describing.

For instance, in our longitudinal study we found that whereas 28% of the women in our sample graduated as education majors (mainly in elementary-school teaching), only 2% of our men did so. Though there is a tendency for education to be chosen by relatively field-dependent persons, in the case of women the sex-role stereotype that teaching is women's work was apparently so influential that teaching was selected by more than a quarter of our female sample, among whom there were obviously a number of relatively field-independent women. Again reflecting the influence of sex-role stereotypes, 21% of the men in our sample, as compared with 5% of the women, majored in science. A similar pattern has been reported by Goldman and Warren (1973). They found that the college men in their sample were much more likely than the college women to major in the physical and biological sciences, whereas the women were more likely to major in the humanities.

Further evidence of the interplay of cognitive style and sex-role assignment in the development of vocational orientation comes from a study by Scheibner (1970). Scheibner found that field-independent college men had more Mathematical-Analytical-Research and Scientific interests than their field-dependent male peers. However, when field-independent and field-dependent women were compared, the field-independent women significantly more often endorsed such items as author, editor, and columnist. Field-independent women also scored higher (though not significantly) than field-dependent women on the Artistic-Aesthetic and Entertainment-Expressions interest scales. Vernon (1972) found that greater field independence was associated with artistic interests for eighth-grade girls but not for eighth-grade boys. A reasonable interpretation of these two studies is that the field-independent females tended to have interests consistent with more socially acceptable feminine sex roles.

What about those who break away from traditional sex roles? Is the woman who conforms less to traditional life styles and who ventures into the more masculine areas more field independent than the woman who adheres to the more traditional feminine role? There is some support for this notion. In two studies (Corbett, 1974; Welkowitz, Note 13) field-dependence-independence related significantly to attitudes toward women, with field-dependent women favoring a more "conventional," family-oriented role and field-independent women favoring a more "liberated," career-oriented role. Patrick (1973) found that women working for advanced degrees in "male-dominated professions" (lawyers, doctors, architects, and scientists) were more field independent than female college graduates who were, at the time of the study, engaged in full-time homemaking. Similarly, Manning (1969) found that homemaking motivation related to field dependence. In the same vein, Greenwald (1968) found that relatively field-independent women strongly favor an "intellectual role" for themselves, whereas relatively field-dependent women favor a "woman's role" just as strongly. On the other hand, Manning (1974) was unable to demonstrate a relation between field independence and career motivation for women, and Abelew (1974) found no relation between field-dependence-independence and sex-role attitude (family-oriented versus self-oriented) for senior high school girls (as well as boys). Abelew points out a troublesome pitfall inherent in attitude questionnaires, however. Even though field-dependent and field-independent girls may both endorse a more liberated sex-role attitude, they may do so for different reasons. In response to the times, the field-dependent girls may be adopting these attitudes because they are socially in vogue rather than because of a greater sense of separate identity.

In reporting the evidence on sex differences, whether in cognitive style, or in educational and occupational interests, choices, and performance, we are simply describing the situation as it now stands. There is no assumption that this is the way it must be. Whether through the action of the individual or of society, the sex-differences picture in the linked characteristics of cognitive style and interests-choices-performance can undoubtedly be altered, should such a change be desired.

The evidence reviewed in this section on career differentiation allows us to conclude that cognitive styles play an identifiable role, apparently starting quite early in life, in the complex process of an individual's educational-vocational evolution. Knowledge about students' cognitive styles may be useful to students themselves—and to those in a position to guide them—in the identification of suitable career goals.

A word of caution is in order, however, against using the relations now found to exist between cognitive styles and educational-vocational interests, choices, and performance to perpetuate a self-fulfilling prophecy. It has been observed repeatedly, as we have seen, that relatively field-dependent students are not likely to do as well in mathematics and the sciences as more field-independent students. However, to this statement must be added the qualification: "with the present ways of teaching these disciplines." We have suggested that other methods than those commonly used in teaching mathematics and science—and perhaps even other kinds of teachers than those now predominantly engaged in teaching these subjects—may help field-dependent students perform better in these subjects than they now do. As we come to know more about how such students learn and the kinds of people they are, we will be in a better position to devise teaching approaches helpful to their mastery of these subjects. More positive experiences in their early encounters with mathematics and science may also encourage field-dependent students to be more venturesome in trying these disciplines. We may think in a similar way about doing more to help field-independent students with domains where interest in people and social sensitivity and skills are important. It is not difficult to see the benefit to some domains, such as medicine, in having in them more persons with both analytical/structuring competence and a social orientation.

We do not yet know what needs to be done, or how far it is possible to progress, in training students to move outside the channels into which we now find them directed by their cognitive styles; the malleability of learning approaches fostered by cognitive styles encourages us to believe that such movement can be achieved. We do not assume that everyone can take equally well to all domains or that it is a desirable goal of education to create a universe of jacks-of-all-trades. However, for the educator, the development of greater diversity in behaviors within individuals seems as important an objective as the recognition and the utilization of diversity among individuals.

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Learning Style: The Myth, The Panacea, the Wisdom

Mr. Davidman examines critically the work of some prominent educators in the area of learning styles, particularly Rita and Kenneth Dunn and Gary Price. The Dunn/Price work on learning styles, he says, promotes a "false sense of knowing" and, in promoting the child's judgments of his or her own needs, "undermines the greater vision of public education." Responses from Dunn/Price and David Hunt follow.

Leonard Davidman

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Would you like to identify your students' learning styles with scientific precision? Are you interested in creating learning environments that allow students to realize their potential fully? Do you want to personalize your curriculum with a power and sophistication that goes far beyond the best efforts of past decades? If your answer to these questions is yes, you may be ready to join the revolution to which James Keefe, coordinator of research for the National Association of Secondary School Principals (NASSP), alluded when he wrote:

> Learning style is much more than just another innovation. It is a fundamental new tool with which to work. It is a new way of looking at learning and instruction, a deeper and more profound view of the learner than known previously. It is a basic framework upon which a theory and practice of instruction can be built. It makes obsolete any single framework for teaching all students. All recent innovations, whether staff utilization, modular scheduling, independent study, or fundamental education, must be rethought in the light of learning style. It is nothing less than revolutionary to base instructional planning on an analysis of each student's traits.[1]

But before jumping on this latest bandwagon, a bandwagon that is headed in an important and appropriate direction, you would be wise to examine cautiously the various assertions made by researchers who are studying the concept of learning style. At least a half dozen researchers have mapped out useful positions in the geography of learning style, and most of these positions have been clearly presented in the NASSP publication, *Student Learning Styles: Diagnosing and Prescribing Programs.*[2] The several contributors to this timely volume state clearly their interest and faith in the learning style concept. They agree that practical knowledge about the diagnosis and application of learning style is available now. But the unanimity stops there. The authors display crucial and significant variance regarding the nature of that practical knowledge.

To illustrate the important differences and problems that exist, I shall examine critically two approaches to learning-style-based education (hereafter LSBE). Initially, I intend to compare and contrast the work of David E. Hunt, professor of applied psychology at the Ontario Institute for Studies in Education, and the team of Rita Dunn, professor of curriculum at St. John's University; Kenneth Dunn, superintendent of the Hewlett-Woodmere (N.Y.) School System; and Gary Price, associate professor of counseling education at the University of Kansas. I shall examine the definitions, philosophical assumptions, and pedagogical prescriptions of both Hunt and Dunn/Price,[3] giving the Dunn/Price work a more extensive analysis and critique. Finally, I shall outline a personalized, qualitative approach to LSBE that draws on the work of Dunn/Price, Hunt, and Madeline Hunter.

Let us begin with the Dunn/Price definition of learning style, which is "the manner in which at least 18 different elements from basic stimuli affect a person's ability to absorb and retain [information]."[4] These elements include the influence of sound, light, temperature, time of day, need for food or beverages, and the answer to such questions as: Does the individual prefer to learn alone? Does he or she prefer to learn with and from peers? Does he or she prefer to learn from, or without, adults? Does he or she prefer to learn from tactile and kinesthetic teaching aids? To put it another way, according to Dunn/Price learning style is the aggregate of the student's own opinions about the way he or she learns.

Hunt, on the other hand, says, "Learning style describes a student in terms of those educational conditions under which he is most likely to learn."[5] He also states that "to say that a student differs in learning style means that certain educational approaches are more effective than others for him."[6] Interestingly, neither Hunt nor Dunn/Price address, in their basic definitions, the malleability or durability of learning style. But their pedagogical prescriptions do reveal some assumptions regarding this important question. In order to know how to react to a student's learning style, teachers must know more about the psychological and biological attributes of learning style. For example, if learning styles are nothing more than moderately strong habits, then teachers could certainly aspire to modify or extend learning styles. Conversely, to the extent that learning styles are a function of biological attributes and developmental constraints, the potential for modification and extension will be diminished.

What do the teaching recommendations of Dunn/Price and Hunt imply about the nature of learning style? Dunn/Price recommend that teachers in grades 3 through 12 use the Learning Style Inventory to identify the learning style of each student in a class. The teacher is then advised to use the *Learning Style Manual* to create a differentiated learning environment, which theoretically will reinforce the potential within each student's learning style.[7] The educational value of the Dunn/Price program, which is a formal, standardized test-oriented approach to personalized education, depends primari-

From *Phi Delta Kappan*, May 1981.

ly on two factors. The validity and reliability of the Dunn/Price Learning Style Inventory (an instrument that Dunn/Price report they have field-tested successfully) is the first factor. The second factor concerns the practicality of the strategies recommended in the *Learning Style Manual*. These strategies, supported by the forceful, confident remarks the Dunns make in their text, *Teaching Students Through Their Individual Learning Styles: A Practical Approach*,[8] demonstrate that they honor an old but still influential conception of the learner. They assume that human beings possess certain consistent, enduring traits, such as IQ or learning style, that are difficult to change significantly.

In contrast, Hunt's recommendations to teachers suggest that he views learning style as a malleable trait. Hunt's primary research has been on "conceptual level," that is, how much structure a child needs in order to learn best. His work in this aspect of learning style has led him to speculate about general approaches to LSBE; like the Dunns, Hunt recommends that teachers assess students' learning styles. However, his approach, while systematic, is decidedly informal. Echoing Madeline Hunter,[9] Hunt states that teachers who would assess learning style must become aware of how learning style differs from ability and then must systematically vary the structure of their approach to teaching and observe the results.[10] For Hunt, it is the *teacher's* disciplined trial and evaluation of results that decide the amount of structure individual students need in order to learn most efficiently. This is quite different from the Dunn/Price strategy, which employs a statistical analysis of the opinions a student expresses on a questionnaire to identify that student's learning style and the subsequent learning environment.

In Hunt's approach, the teacher's experience and classroom observation are the prevailing factors; in the Dunn/Price model, the students' self-perceptions are most influential. The difference between the two positions is even greater, however, because Hunt believes that "learning style refers to how much he [the learner] requires, not necessarily how much he prefers."[11] Obviously Hunt believes that students' preferences regarding classroom structure may be quite different from their real educational needs. He also believes that it is possible to work with a new concept like learning style while still adhering to the older planning tradition that relies on student needs as determined by *teachers'* opinions to formulate objectives and teaching strategies. Dunn/Price would probably argue that students know their own learning needs better than their teachers and that they reveal these needs when they share their learning style preferences. Although this point may be partially true for high school students, I believe that the opinions provided by elementary school students, who have had limited exposure to different ways of learning and self-evaluation, should be considered speculative.

As educators learn more about learning style, we may be able to help learners of all ages become more perceptive about their learning styles, their needs, and the difference between these two concepts. But that is the desirable future and not the difficult present.

Let me make one more crucial point regarding Hunt's approach to LSBE. For Hunt there is only one goal for LSBE. He writes that "any [educational] approach should be directed to the long-term developmental goal of increasing the student's independence and initiative, i.e., extending his learning style."[12] Hunt views learning style as an attribute that can (and should) change with personality growth. For him, LSBE is a process that leads to increased autonomy and expansion of learning style. Hunt would be dissatisfied, I think, with a form of LSBE that did not view personalized education as a vehicle for social growth.

At this point, examining the Dunn/Price model with Hunt's perspective in mind should prove illuminating. As I mentioned earlier, to assess the educational value of the Dunn/Price approach to LSBE one must ask basic questions about the Learning Style Inventory and the instructional recommendations in the *Learning Style Manual*. Is the Learning Style Inventory valid? Does it measure and identify what it claims to? More specifically, is it likely that an analysis of the inventory's 104 true/false questions will allow the accurate identification of a student's preferred learning style? For this to be the case, the inventory questions should clearly reveal the components they seek to assess.[13] If the inventory questions are ambiguous or simply the kind that might trigger different *types* of responses in students, then the central conclusions of the inventory are going to miss the mark.

In fact, my analysis of the Learning Style Inventory questions and components suggests that they are far more open to varying interpretations than Dunn/Price indicate. An analysis of two inventory components should clarify this point.[14] The following questions comprise the "teacher-motivated" component:

> I like making my teacher proud of me. (LSI #15)
>
> I think my teacher feels good when I do well in school. (LSI #41)
>
> I like my teacher to check my schoolwork. (LSI #54)
>
> I think my teacher wants me to get good grades. (LSI #97)
>
> I cannot get interested in my schoolwork. (LSI #59)
>
> Things outside of school are more important to me than my schoolwork. (LSI #11)
>
> There are many things I like doing better than going to school. (LSI #30)

For the child who is judged teacher-motivated — that is, one who answers "true" to numbers 15, 41, 54, and 97, and "false" to numbers 59, 11, and 30 — the teacher receives the following advice in the *Learning Style Manual* (p. 5):

> Establish den area near teacher; praise often; incorporate reporting to teacher into prescription; include in small-group instructional techniques when teacher is involved.

It is possible, judging from this advice, to infer that the non-teacher-motivated student should *not* have a den area near the teacher, should *not* be praised often by the teacher, and need *not* be involved in small-group activities headed by the teacher — because this student is simply not teacher-motivated. Presumably this child is motivated by other people and/or other things (and/or him- or herself).

But do these questions really reveal this "teacher-motivated" characteristic so clearly? Do "false" answers to statements 15, 41, 54, and 97 necessarily indicate that a student does not 1) enjoy making the teacher proud of him or her, 2) like the teacher to check his or her work, or 3) believe the teacher wants him or her to get good grades or do well in school? Is this child merely saying that he or she is an independent learner who doesn't need a great deal of teacher attention and praise in order to be motivated? Or might that student be hinting that there is something terribly wrong with the teacher/student relationships in the class? If the teacher passively accepted the superficial meaning and false precision provided by the Dunn/Price guidelines, a valuable message could easily be lost. Human analysis, probing, perhaps even another informal questionnaire must follow the initial computer scoring if the authentic meanings of the informative but superficial Learning Style Inventory data base are to be discovered. There are simply too many ways students can misinterpret, or interpret inventively, questionnaires that seem very clear to adults. Students taking the Learning Style Inventory in late September, for example, might have difficulty with the "teacher-motivated" component because they don't know their teacher well enough yet. It is conceivable that these students might answer numbers 15, 41, 54, and 97 with

last year's teacher in mind. Or they might not indicate how they *really* feel because sufficient teacher trust and rapport has not yet been developed.

Similarly, the questions making up the "responsibility" component also suggest the need for caution:

> I have to be reminded often to do something. (LSI #44)
>
> I have to be reminded often to do something. (LSI #49)
>
> I keep forgetting to do the things I've been told to do. (LSI #82)
>
> I remember to do what I am told. (LSI #42)

For the student who is not responsible — that is, the student who answers numbers 14, 49, and 82 "true" and number 42 "false" — the *Learning Style Manual* prescribes the following (p. 6):

> For individuals who are not responsible, design short-term, limited assignments with only single or dual goals; provide few options and frequent checking by the teacher; directions should be simple and responsible; peers should be placed in the immediate environment and on the same projects. Base assignments on interests and use appropriate praise and rewards.

What do these prescriptions tell us about the Dunn/Price understanding of responsible and irresponsible behavior? First, they assume that the major problem — for all children responding with three "trues" and one "false" — lies in the type of assignments and a lack of praise. Dunn/Price believe that shorter, more clearly defined lessons accompanied by more frequent teacher supervision and praise will diminish the problem. This may well be true for some children, but many other factors could explain the above-mentioned responses. Moreover, it's significant that these "below-the-surface" realities typically require human dialogue and trust between teachers and pupils before they emerge. For example, a Dreikursian analysis suggests that this pattern of avoiding responsibility might be a way for a child who fears embarrassment to avoid displaying "inadequacy" or for another child, whose ego needs may be great, to gain classroom influence indirectly.[15] Such children may not fully understand their own motivations and behaviors; even if they do, they may not reveal this understanding on a true/false questionnaire. While the above-mentioned Dunn/Price prescription might partially cover the needs of the child who fears embarrassment or simply needs praise, it ignores completely the needs of the child who desires power.

My point (an important one) is this: Many of the Learning Style Inventory questions provide interesting information, but this information should not be taken as a clear and irrefutable indication of a child's pattern of learning. At best, the inventory should be construed as yielding "informed speculations" that can serve as points of departure for in-depth student/teacher/parent dialogues. Used in this fashion, the Learning Style Inventory or an abbreviated version of it could be quite valuable. Unfortunately, its authors believe that their instrument yields precise, accurate conclusions about individual students' preferred learning styles; moreover, Dunn/Price maintain that one can move from the computer analysis of the student's preferred learning style and class profile (a summary of the Learning Style Inventory responses of the entire class) to a discussion in which teacher and student use the inventory results to "explore potential alternatives for maximizing achievement based on the individual's needs."[16] Nowhere in the *Learning Style Manual* is the teacher encouraged to explore the meaning of the student's responses. And yet the selection and phrasing of the inventory questions demand such probing by teachers.

Ironically, the Learning Style Inventory, a tool designed to facilitate personalized education, may in fact undermine this process. It leads teachers to believe that they possess a body of deep, significant, personal knowledge when in fact the information provided by the inventory is fairly superficial.

But the problem with the Learning Style Inventory is more serious than the false sense of knowing it fosters. The educational philosophy embedded in the Learning Style Inventory and *Learning Style Manual* is a philosophy that needs improvement. Although Dunn/Price have not articulated the key elements of this philosophy, one can discern in their writing the following belief system:

1. All children have one learning style or another.
2. Learning style is a deep rather than a superficial trait; it has psychological as well as biological aspects and cannot be easily modified.
3. Children in grades 3 through 12 can reveal their preferred learning styles quite lucidly and simply through the Learning Style Inventory.
4. After a child's preferred learning style has been identified, a personalized learning environment keyed to the student's preferences should be created for each child.
5. Preferred learning styles should be considered positive attributes; children are entitled to their preferred learning styles, to success in learning, and to a personalized learning environment; teachers should neither disparage nor begrudge a child's need for structure, intake (food), or a peer-oriented environment. Such preferences are potential building blocks, and teachers must stop thinking that all children can be fit into the same mold.

This view of personalized education places the student (and his or her expressed preferences) at the center of the educational universe. It suggests that schools exist to teach children basic literacy skills in the manner that is most effective and convenient *to the students*. And, in so suggesting, it undermines the greater vision of public education as a vehicle for creating enlightened citizens. A view of the educational universe with citizenship in mind posits society and the student at the center, the one embedded in the other. Therefore, a personalized curriculum demands that the citizenship educator consider not only the needs and preferences of the students but the needs of the local community and the larger society as well. Schools exist to serve both society and the individual; striking the proper balance is not a job for a computer, a 104-item questionnaire, or a 10-year-old child.

There is yet another danger inherent in the Dunn/Price philosophy: It could be used to support the efforts of parents who would remove their children from the public schools altogether. As I have mentioned, Dunn/Price maintain that the way a child prefers to learn is the easiest, most effective, and most appropriate way for that child to learn. If a child indicates that he or she is primarily a visual or aural learner who likes to learn in the late afternoon, in a cool climate, alone, with music in the background, and health food or liquids available, Dunn/Price would have educators create a learning environment designed to fulfill these conditions. But for such a student, why have school at all? The preferred learning style I have described suggests that he or she would learn most efficiently at home. And what about the student who goes beyond the Learning Style Inventory and tells the teacher that he finds girls and/or minorities distracting? Surely this inability or tendency is as real as the inability to learn from adults. In short, educators using the inventory in the manner prescribed by Dunn/Price may find that the problems it creates far outweigh the solutions it provides.

However, as I implied earlier, teachers can adapt the Learning Style Inventory to their own purposes. The inventory *does* address important issues. Teachers who had not considered the effects of light, temperature, and selected teaching strategies on particular children will be stimulated to do so.

What form should this adaptation take? The basic direction should be from formal, quantitative, and moderate teacher involvement to informal, qualitative,

and high teacher involvement. Individual teachers (or groups of teachers) can use the Learning Style Inventory and similar instruments to create their own mini-questionnaires.[17] This involvement in the design process should motivate teachers to invest time in the crucial follow-up questioning of individual students. These ongoing, one-to-one or small-group dialogues about individual learning preferences will help create a collaborative learning environment, and this environment in turn creates a strong foundation for self-directed learning.

Further support for this informal, personalized approach to LSBE can be found in Madeline Hunter's article, "Diagnostic Teaching."[18] In this informative essay Hunter distinguishes among three useful types of diagnosis: formal, informal, and inferential. After noting that well-designed tests are the common tools of formal diagnosis, Hunter writes:

> Informal diagnosis is the heart and core of diagnostic teaching. For each individual or situation, informal diagnosis yields bountiful information at the moment it is needed. The information may be less accurate than the results from formal diagnosis, but the information is reasonably reliable and immediately available. . . . Informal diagnostic information may be obtained through group feedback or sensitive observation.[19]

Hunter also emphasizes that teachers should be concerned with diagnosis of learning style and that teachers, rather than computers, have the analytical qualities crucial to such diagnosis.[20] This essay also illuminates Hunter's basic position on LSBE. In its espousal of learning style variety and expansion, her position meshes neatly with David Hunt's.

My approach to learning style diagnosis builds upon Hunter's approach, which relies heavily on teacher observation, group verbal and nonverbal feedback, and formal diagnosis (based on scientifically standardized tests). I believe that brief teacher-made instruments will initiate a more useful diagnostic process. These 10- to 20-question inventories, perceived as points of departure, will provide the rudimentary material for the follow-up conferences and, ultimately, a responsible form of personalized education. Indeed, these heightened individual dialogues, created through a variety of strategies — student autobiographies, classroom meetings, questionnaires, monthly individual conferences, outdoor overnight camping trips, etc. — will create the vital core of personalized evaluation and education. And it will be within the context and relationships created by these extended dialogues that the wisdom of learning-style-based education will be discovered.

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1. James W. Keefe, "School Applications of the Learning Style Concept," in J. W. Keefe, ed., *Student Learning Styles: Diagnosing and Prescribing Programs* (Reston, Va.: National Association of Secondary School Principals, 1979), p. 131.
2. Ibid.
3. In this article I shall use Dunn/Price to indicate the work of three authors, Rita Dunn, Kenneth Dunn, and Gary E. Price.
4. Keefe, op. cit., p. 41.
5. Ibid., p. 27.
6. Ibid.
7. More information about the Learning Style Inventory and the *Learning Style Manual* can be obtained by writing Gary E. Price, Price Systems, Box 3271, Lawrence, KS 66044. The inventory and manual referred to herein are the latest (1979) versions.
8. Rita Dunn and Kenneth Dunn, *Teaching Students Through Their Individual Learning Styles: A Practical Approach* (Reston, Va.: Reston Publishing Company, 1978).
9. Madeline Hunter, "Diagnostic Teaching," *Elementary School Journal*, September 1979, p. 45.
10. David Hunt, "Learning Style and Student Needs: An Introduction to Conceptual Level," in Keefe, op. cit., p. 31.
11. Ibid., p. 32.
12. Ibid., p. 28.
13. Each question in the Learning Style Inventory is part of a set that determines a particular learning preference. The items in each of the 24 Learning Style Inventory areas, which I refer to as components, can be gleaned from data on page 31 of the *Learning Style Manual*. The 24 preferences or components are: 1) sound — quiet or sound preferred, 2) light — bright or low, 3) temperature — cool or warm, 4) design — informal or formal, 5) motivated/unmotivated (self), 6) adult-motivated, 7) teacher-motivated, 8) persistent or not persistent, 9) responsible or not responsible, 10) structure — needs or does not need structure, 11) prefers learning alone, 12) peer-oriented learner, 13) prefers learning through several ways, 14) prefers learning with adults, 15) has auditory preferences, 16) has visual preferences, 17) has tactile preferences, 18) has kinesthetic preferences, 19) food — requires or does not require intake, 20) functions best in morning, 21) functions best in late morning, 22) functions best in afternoon, 23) functions best in evening, and 24) mobility — needs or does not need mobility.
14. For a lengthier analysis of the Learning Style Inventory, see "Learning Style: A New Approach to Personalized Education" (Unpublished manuscript, available from Leonard Davidman, Education Department, California Polytechnic State University, San Luis Obispo, CA 93407).
15. A major element in Rudolf Dreikurs's explanation of human misbehavior is the idea that behavior is goal oriented and most often aimed at one or more of these five goals: mutual cooperativeness, attention, power, revenge, and the avoidance of displaying inadequacy. A more detailed explanation of this idea can be found in *A New Approach to Discipline: Logical Consequences* by Rudolf Dreikurs and *Maintaining Sanity in the Classroom* by Rudolf Dreikurs, Bernice Grunwald, and Floy Pepper (New York: Harper and Row, 1971).
16. See the *Learning Style Manual* (1979), p. 4.
17. Teachers interested in creating their own informal questionnaires will find helpful material in: Manuel Ramirez III and Alfredo Castaneda, *Cultural Democracy: Bicognitive Development and Education* (New York: Academic Press, 1974); Hunter, op. cit., p. 45; and the work of E. Paul Torrance et al.: Torrance, Cecil R. Reynolds, Theodore Riegal, and Orlow Ball, "Your Style of Learning and Thinking, Forms A and B," *Gifted Child Quarterly*, Winter 1977, pp. 563-73; Torrance and Reynolds, "Images of the Nature of Gifted Adolescents: Effects of Alienation and Specialized Cerebral Functioning," *Gifted Child Quarterly*, Spring 1978, pp. 40-54.
18. Hunter, op. cit., p. 45.
19. Ibid., p. 42.
20. Ibid., p. 45.